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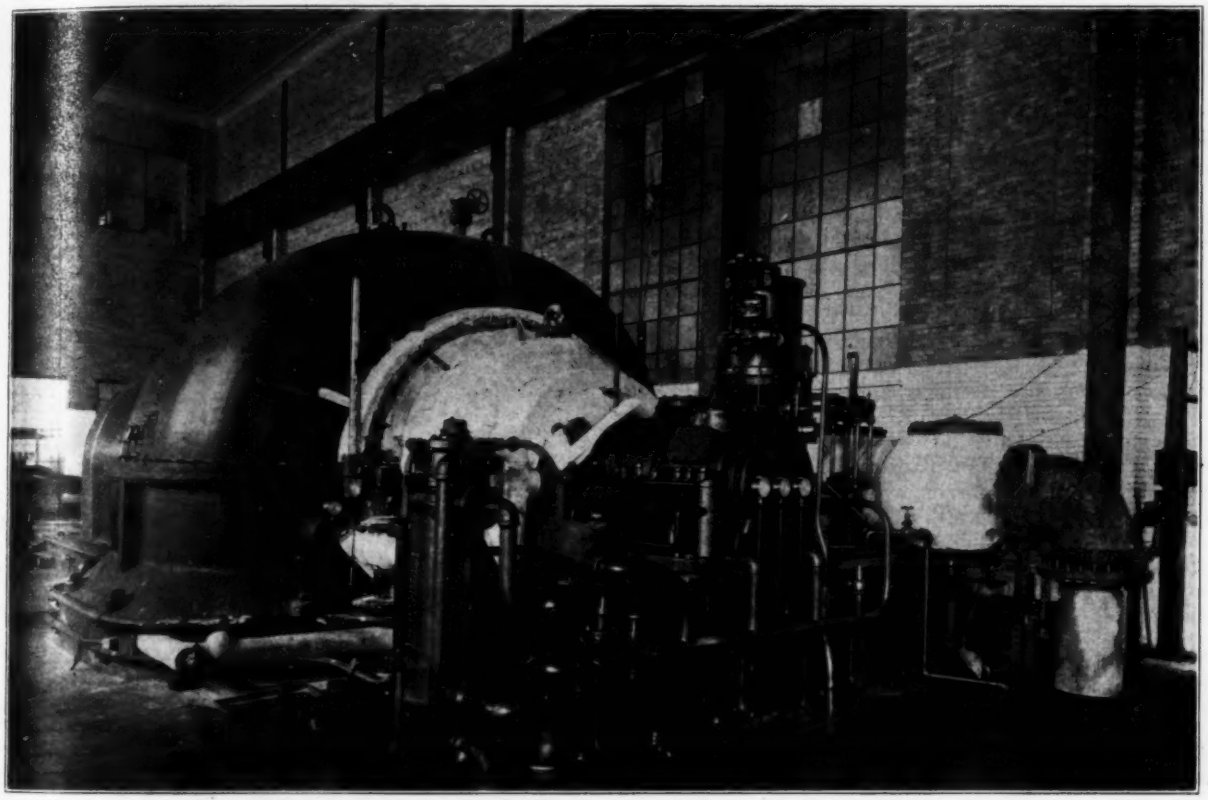


View of 25,000-Kw. Curtis Turbine From Steam End, With High-Pressure Element Casing in Process of Being Covered With Asbestos.

Cincinnati's New 100,000-Kilowatt Power Station

Second Installment of Article Describing Steam and Electrical Features of Union Gas & Electric Company's New Station With Initial Capacity of 50,000 Kilowatts

THE TWO Curtis generators are 25,000-kw. (31,250-kv.a. at 80 per cent power-factor) three-phase, 13,200-volt, 60-cycle machines, each with its own exciter, a 140-kw., 250-volt, shunt-wound direct current generator with capacity and connections for exciting both 25,000-kw. generators. Auxiliary to each main generator is a ventilating or cooling set equipped with the Spray Engineering Company's air washing and cooling apparatus. Each of these units has capacity for cooling and humidifying 60,000 cu. ft. of air per minute.

A special storage battery furnishes emergency excitation for any generator field in case of failure of the direct-connected exciters. A third source for excitation current is provided in a steam-turbine-driven set with two direct-connected generators, one of 200 kw., 250 volts, for the exciter bus, and the other of 200 kw., 600 volts, for emergency supply to the 600-volt direct-current bus that supplies the direct-current station auxiliaries, such as stoker and blower drives, crane motors and electric locomotive. Normally this set is idle and the 600-volt direct current is supplied by two synchronous converters of 750 kw. each connected on the alternating-current side through transformers to

the station bus. These rotaries, as well as the special turbine set just referred to, are located on the turbine-room floor.

All the induction motors for either unit or miscellaneous station auxiliaries are supplied with 600-volt, three-phase current by means of Westinghouse three-phase, 1800-kv.a., 13,200/600-volt transformers. Each main generator normally supplies one of these transformers for furnishing energy to its own auxiliaries. There is also a spare unit for supplying the 600-volt, three-phase station bus feeding miscellaneous station motors.

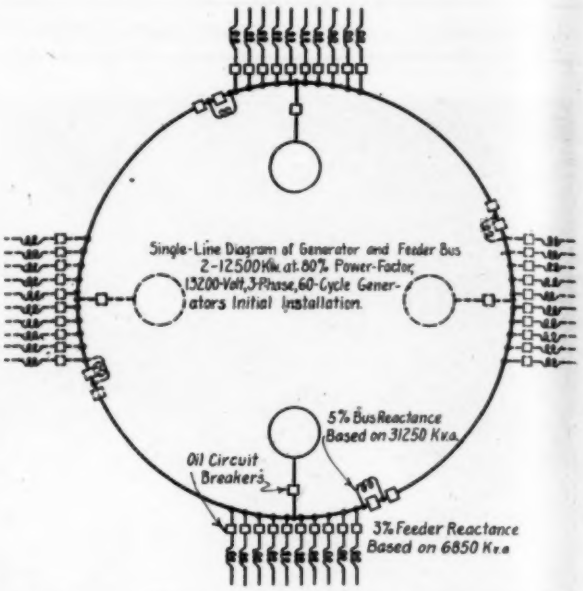
The main electrical connections are shown by single-line diagram. This diagram shows the generator bus and reactors, used for generator protection and bus sectionalization, arrangement of supply for auxiliaries for the individual machines, and the three sources of excitation, etc.

The accompanying one-line diagram shows the general scheme of generator wiring. Each generator supplies its own section of the main generator bus and feeders, the bus being arranged on the ring system. Each generator is separated from the other generator on the bus by a 5-per cent reactance. These reactances are interlocked with their respective generator circuit breaker with a short-circuiting switch so that the reactance comes into circuit as and before the main generator circuit breaker opens. In this way the energy to be interrupted by the breaker is reduced, voltage drop across the reactance is obviated, and at the same time difficulties that might arise due to intervening reactance between generators operating in parallel or at times inserted in each feeder of unequal load distribution when paralleling are eliminated. Both generator and sectionalizing breakers are non-automatic, while the feeder breakers are protected by overload relays with time element tripping.

Operating Room and Switch House.

At the west end of the turbine room is the operating and office section of the station. The station operator's room, from which all major operations are remotely controlled, is located so as to overlook the entire turbine room. Here are also offices for the chief engineer and load dispatcher, first-aid quarters, drafting room, sleeping room for certain operators, and restaurant space.

All of the switching and switchboard equipment in the operating room and switch house, as well as several unit and station-auxiliary panels, are furnished by the Westinghouse Electric & Manufacturing Company. The main operating board is of the benchboard type and controls the main generators and the exciters, also the primaries of the unit-auxiliary and station-auxiliary transformers. Outgoing feeders are controlled from a vertical board with 14 two-circuit panels. Another vertical board with 14 panels carries the watt-hour meters and other instruments for the feeders. Other special panels are provided for auto-

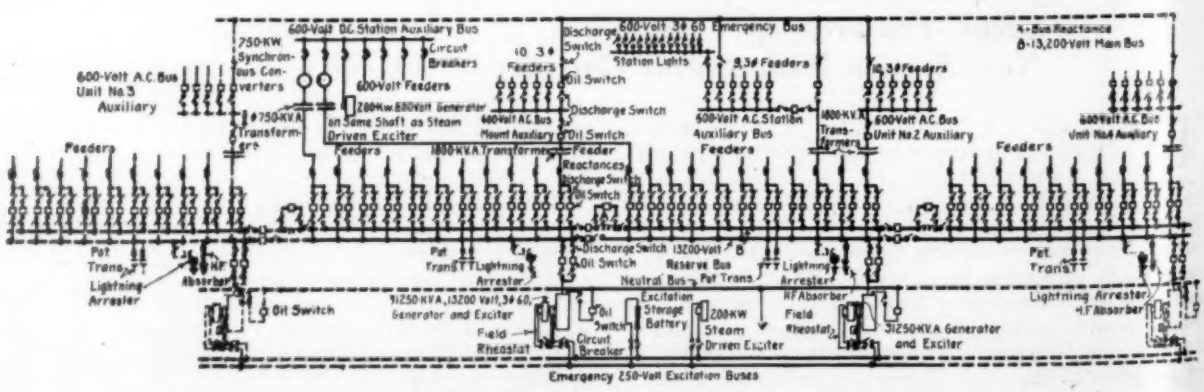

Single-Line Diagram of Generator and Feeder Bus
2-12,500 Kw. at 80% Power-Factor,
13200-Volt, 3-Phase, 60-Cycle Generators Initial Installation.
5% Bus Reactance
Based on 31250 Kv.a.
Oil Circuit Breakers
3% Feeder Reactance
Based on 6850 Kv.a.

Single-Line Diagram Showing Generator Ring Bus and Outgoing Feeders.

matic voltage regulators, curve-drawing instruments, synchronizers, relays, etc.

On the operating floor of the turbine room are three auxiliary boards, each with five two-circuit panels for controlling the main circuits for the auxiliaries for the units and for general station service. Other special panels are also found in different parts of the station. In no case do any of the high-voltage circuits come near any of these panels nor those of the operating room.

The 13,200-volt generator circuits are carried up directly in special Orangeburg bituminous fibre ducts to the switch-house floors over the turbine room where all the high-voltage switching is done in individual cells. The bus-bars and oil switches are isolated in concrete and stone compartments. Triple-pole, single-throw, cell-mounting, solenoid-operated, oil circuit-breakers rated at 22,000 volts, 2000 amperes, are used for the main generator and bus-sectionalizing switches.

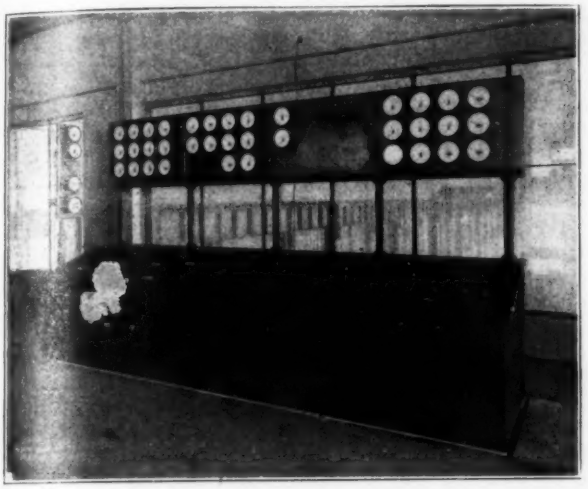


Single-Line Diagram of Station Wiring.

and similar breakers of 22,000-volt, 600-ampere rating are used as switches for the 300-ampere feeders.

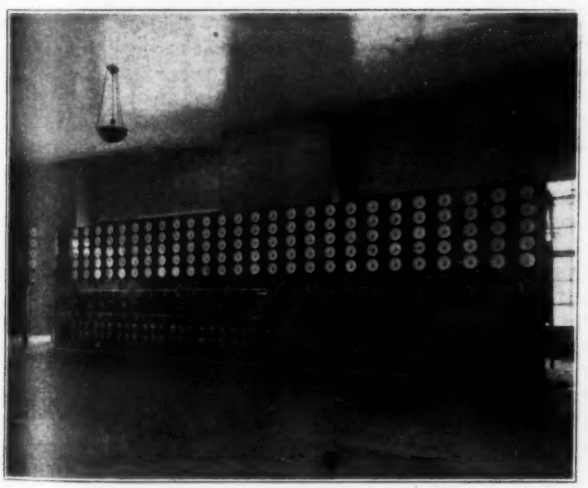
Outgoing Feeders and Underground Conduit Construction.

All of the outgoing feeders are supplied at 13,200 volts. They all leave the station in underground con-



Benchboard Controlling Generators and Bus Tie Switches.

duit lines of special construction near the plant and supply the company's several substations on the radial-feeder plan. At the alternating-current substations the voltage is stepped down by 2000-k.w. single-phase transformers from 13,000 to 4500 volts and distributed over the four-wire, three-phase distribution system now in service. At the two direct-current substations



Feeder Panels.

the voltage is stepped down for supplying 60-cycle, interpole booster converters feeding the Edison 275-volt, three-wire direct-current system. Several Westinghouse converters of this type and rated at 3500 k.w. are installed, together with Westinghouse switchboards therefor. The alternating-current substations have switchboards of General Electric manufacture.

The feeder cables are lead-sheathed, paper-insulated, three-conductor cables with conductors of 400,000 circular-mil size. These are understood to be the largest 13,200-volt cables ever made, having a diameter of 3.25 inches. The cables are drawn into 4.5-inch Orangeburg fiber duct for the most part. A total of about 674,000 duct-feet of underground construction is installed, of which about three-fourths is fiber duct and one-fourth tile duct. The conduits are arranged two ducts wide and two to five high to give maximum strength and low installation cost. About three inches of concrete separates the ducts and surrounds the entire conduit.

MONEY SAVED BY A SOOT CLEANER.

Some interesting computations have recently been made available by the Vulcan Soot Cleaner Company, Du Bois, Pa. They show that a soot cleaner saves much more money during its lifetime than is generally supposed. The computations have been simplified to "savings per ft. of pipe." Thus they find that each foot of pipe used in connection with a permanently installed soot cleaner saves approximately 18.3 tons of coal during the lifetime of the cleaner. In addition, each foot of pipe saves one man's labor for one day.

Since the average water tube boiler requires about 200 feet of pipe, the total money saved, or the money saved by the reduction of labor cost alone, is easily computed. In some cases, it is found that the computed labor saving alone pays for the cleaners. The money saving due to the lower coal consumption is, of course, many times larger.

Wages at the present time are high, but if it is assumed that boiler room labor can be secured at $2.00 per day, the labor saving with the average cleaner is $\$2.00 \times 200 = \$400.00$ for the lifetime of the cleaner.

As for coal saving, if assuming the price of coal to be $4.00 per ton and 200 ft. of pipe per cleaner, the money saving for the lifetime of the cleaner will be:

$$\$4.00 \times 18.3 \times 200 = \$14,600.00.$$

Add this to the $400.00 obtained above and a total saving of $15,000.00 is obtained. These figures vary with labor and coal cost, but can be easily adjusted to fit all conditions and thus determine whether or not a permanently installed soot cleaner would be profitable in any plant. These figures are based on boilers operated at 140 per cent capacity, average coal consumption 4 lb. per b.h.p. per hour, boilers operating 24 hours per day, 325 days per year. It is also assumed in the above that the life of a Vulcan cleaner is seven years, which is claimed to be a very conservative figure.

The fact that those who have installed permanent soot cleaners never do without them after once trying them is convincing proof that they are an economy factor. Inasmuch as a cleaner costs only a fractional part of $15,000.00, the saving computed above, there can be little question about the desirability and profit in such an investment.

IMPORTANT POWER CONTRACT FOR NORTHWESTERN UTILITY.

The Northwestern Power & Manufacturing Company, Port Angeles, Wash., has connected its power lines with the suction dredge of Tacoma Dredging Company, which has a contract to make a hydraulic fill of 250,000 cubic yards of earth to prepare a site for the Government's spruce sawmill, that is to cut timber in sizes for airplane construction. A connected load of 1000 kw. is required at the dredge for power and lighting. Because the dredging is for Government spruce sawmill, the dredging will be rushed, making the load one of high load-factor.

The Stoker of the Future

Analysis of Mechanical Stoker Evolution as Influenced by Coal Characteristics, Clinker, Efficiency and Rate of Combustion

By JOSEPH HARRINGTON

Administrative Engineer, United States Fuel Administration for Illinois.

THE present crisis in the matter of fuel production, distribution and use has brought the matter of mechanical stoking to a stage where it becomes of first importance in the conservation movement. The fact that stokers are in such extensive use that practically every large power plant has them, renders any argument in favor of mechanical stoking, broadly speaking, unnecessary. That there is a distinct saving in the use of coal by this means has been demonstrated too often to require further repetition.

At the same time, it is timely that the stoker engineer should spend a moment in self-analysis and see if he has the ability to still further improve the product of his genius.

Not only is the stoker part of the power plant essential in the matter of efficiency, but at the peak of the load is an absolute essential. Not only in ability to quickly pick up a load and maintain it but in the actual capacity possible to develop, the mechanical stoker is so far in advance of hand firing that the average electrical power station of today would be virtually helpless without it. Again, when the question of power-plant labor is discussed the advantage of the mechanical stoker assumes proportions which are not approached even by the admittedly important considerations of capacity and efficiency.

As the country is situated today the question of labor both as to quantity and quality is second to no other problem confronting the industrial or power-plant manager. In fact, this item is one which can probably be put at the head of the advantages derived from the use of mechanical stokers as compared to older methods. It would be impractical, even if possible, to put enough men in front of a large boiler to hand fire the amount of coal necessary to develop modern maximum ratings. Whereas, with coal bunkers automatically feeding coal to the stoker, one operating fireman can handle several thousand horsepower in boilers.

As the demands of the Navy and merchant marine, coupled with munition factories of the Atlantic seaboard, have monopolized the low-ash coals of the East, it becomes increasingly important that means be developed for economically securing equal capacities and high efficiency from the high ash and high sulphur coals of the Middle West.

As the ash content increases the heating value of a given coal decreases out of all proportion to the calorimeter determination of B. t. u. My experience shows that 15 per cent ash content on a dry basis is about the turning point. The value of coal as a fuel then declines rapidly and when coal exceeds 20 per cent in ash, special means must be provided for handling it at rates of combustion in excess of say twenty pounds of coal per square foot of grate surface per hour.

The tendency of producers to include sections of the roof and floor together with all included layers of slate and bone has depreciated the quality of coal until a serious situation has arisen therefrom. Without much doubt the increase in mine production the past winter was largely made up of this excess material mined and shipped with the coal. The result, so far as the consumer is concerned, was disastrous, and many stokers which had previously been giving good satisfaction began at once to cause trouble and in many cases actually refused to function. These stokers are particularly those which disturb the fuel in its travel through the furnace. The inert material of this coal fuses at a relatively low temperature and this, combined with its large actual volume, renders the fuel bed sticky and easily balled. Under such conditions when the fuel bed is disturbed clinkers are formed and these clinkers in turn produce others, or themselves grow to a size which renders their removal exceedingly difficult.

Mechanical stoking, therefore, takes on a somewhat new aspect under war conditions and we must be prompt to recognize these conditions and be prepared to meet them in order that the industries of the country shall not suffer from the failure of stoking equipment to handle such fuel. This situation is rendered increasingly critical because of the unprecedented demand for high capacities and continuous service.

What, then, is the answer? A reply based solely on the foregoing considerations would indicate that the ultimately successful stoker must be one which does not disturb the fuel bed to a degree which produces clinkers. The second portion of the answer, which is essential to the complete solution of the problem, is that this stoker must be endowed with the ability to consume quantities of coal corresponding to modern maximum demands. Without doubt artificial draft is necessary to completely satisfy the requirements of sudden peaks and high overloads. That rates of combustion in locomotive fireboxes as high as 100 pounds per square foot per hour have been developed is a matter of record, whereas with the stoker of today whether equipped with forced blast auxiliaries or not, sixty pounds per square foot is about the limit. The resistance to be overcome in any ordinary fuel bed under these conditions is very great and the cost of moving the required volume of air against these pressures is a matter of serious consequence. It is a direct charge against the efficiency of the unit and detracts just that much from the steam available for generating electrical or other power.

Obviously, therefore, a reduction in this tax is highly desirable. This may run as high as 5 per cent of the steam generated or it may go down to 2½ per cent in economical units. Suppose, therefore, that the fuel bed resistance could be reduced even one-half, there would be a saving of perhaps two or three per cent in the power required in the fan auxiliary. We see in this argument, therefore, another sign pointing in the direction of thinner fuel beds. The first sign board we saw pointed directly in the direction of undisturbed fuel beds.

In many instances, of course, the usual chimney draft will be sufficient to produce ratings up to the beginning of peak conditions. Since low load conditions obtain during most of the twenty-four hours we see the third hand pointing in the direction of that stoker which is convertible quickly and easily from natural to forced blast and vice versa.

It is a direct and continuous tax upon the resources of the boiler to have to drive a forced blast fan twenty-four hours any day whether the rating developed is high or low. No further argument is needed to drive home the point that true conservation demands a removal of this tax during all of those hours when it is not absolutely required. In many cases this will be eighteen or twenty hours per day. The balance of the time it is proper to charge the boiler with the additional 2½ to 5 per cent in order to develop therefrom 50 to 100 per cent increased capacity.

To those who desire to carry this analysis further it is interesting to note the conditions of an ideal fuel bed such as have been suggested. Such analysis quickly brings out the fact that it is not possible under the limitations usually affecting the stoker, which otherwise provides these conditions, to maintain a fuel bed resistance equal in all parts of the fire. Obviously then, the draft pressure should be adapted to the requirements of the fuel bed at various points. A division of the fuel bed into three or four parts should suffice and if the wind pressure and volume under both natural and forced blast conditions can be made to conform to the exact requirements of each section of the fire, a condition is approached which is more nearly ideal than anything heretofore reduced to practice.

It must be kept in mind that a big fuel bed is not an essential for producing high CO_2. The Bureau of Mines has demonstrated by careful experiments already published that there is no free oxygen in the air or gas beyond a point 4 in. from the bottom of the fuel bed, provided the fuel bed is formed of a mass of glowing coke.

Uniformity in the character of the fuel bed is therefore the only requisite for complete abstraction of oxygen. The greater portion of the fuel bed of the ideal stoker completely fulfills these conditions and complete combustion is theoretically obtainable.

It is my belief, therefore, that further refinements in the conservation of coal, through the use of mechanical stokers, depends on the ability of the engineer to develop a stoker which will fulfill the following conditions:

(1) Burn coal of any ash content—even up to 50 per cent.

(2) Support this fuel during combustion in such a manner as to preclude the formation of clinkers and the serious consequences that flow therefrom.

(3) Provide a fuel bed of minimum resistance to the flow of air.

(4) Supply to the various portions of the fuel bed air at the right pressure and in the right amount to consume with the maximum of efficiency, combustible matter in such zone, extending up to a maximum of say 100 pounds of coal per square foot of grate surface per hour.

(5) Be readily convertible from natural to forced blast, and vice versa.

Such a design is possible and practical and the writer at least is awaiting with interest the proofs that will confirm this opinion. That everyone would be interested in such a development there can be little doubt and if the country is fortunate enough to find such a stoker it will be one of the longest steps towards coal conservation that has as yet been taken.

CITY OF SEATTLE PURCHASES STREET CAR SYSTEM.

As stated in the September 14 issue of the ELECTRICAL REVIEW, President A. W. Leonard of the Puget Sound Traction, Light & Power Company, and F. S. Pratt, chairman of the Board of Directors, on September 12 announced the acceptance of the offer of the city of Seattle of $15,000,000 for the company's street car lines, appurtenances and equipment. The property sold does not include any power plants, and as stated above, the deal carries with it an arrangement for the company to supply energy to operate the city's street car system. The company operates interurban electric railway lines between Seattle and Everett and between Seattle and Tacoma, and the deal does not affect nor involve in any way its power and lighting systems in the city.

Arrangements are being made to have the change of ownership go into effect about October 1. The transfer will give the city absolute control by ownership of all street railway lines, except that of the Rainier Valley Company, which has small mileage, and steps are to be taken to lease or buy that line.

The purchase of the street car system of the Puget Sound Traction, Light & Power Company comes as the conclusion of a long struggle between the city and the traction company over questions of service and franchise obligations. Many of these questions have been fought through the courts, and in practically all of the litigation the city has been victorious.

Some weeks ago, through the instrumentality of the United States Shipping Board, negotiations between the city and the traction company were begun, with a view of finding some means whereby better service could be furnished the shipyard workers. The company insisted upon securing an increase in fares, which was resisted by the city, which in turn made an offer to release the lines. This was rejected by the company, and last Friday, after an all-day conference between the traction and city officials, and Director A. M. Taylor, in charge of the housing and transportation division of the shipping board, the city submitted its offer to purchase the lines.

WASHINGTON CONTRACTORS REORGANIZE.

The Washington Association of Electrical Contratcors and Dealers met at Seattle, Wash., on September 12 and completed its organization under a constitution provided for by the national association.

YOUR $50 Liberty Bond.

It will protect 1000 soldiers from smallpox and 666 from typhoid. It will assure the safety of 139 wounded soldiers from lockjaw, the germs of which swarm in Belgian soil.

It will render painless 400 operations, supply 2 miles of bandages—enough to bandage 555 wounds.

It will care for 160 injuries in the way of "first-aid packets."

It will furnish adhesive plaster and surgical gauze enough to benefit thousands of wounded soldiers.

Every purchaser of a Liberty Loan Bond performs a distinct individual service to his country and to our boys fighting in France.

Advantages of High Pressure and Superheat as Affecting Steam Plant Efficiency

Possibilities of Higher Steam Pressures and Temperatures for Reducing Mechanical and Thermal Losses in Turbines

By ESKIL BERG

Engineer, Turbine Department, General Electric Company.

THE USE of high steam pressures and superheat is a most effective way of improving economy, and therefore conserving fuel, in steam power plants. This is particularly true of the steam turbine. In developing the steam turbine designers have aimed more and more for higher efficiencies—lower water rate—until today turbines are in operation with a thermodynamic efficiency of 90 per cent.

In reaching out for still higher efficiencies designers find the lower range, namely, the vacuum, fixed by cooling water temperature, hence attention turns to increased steam temperatures. This means higher steam pressures, higher degree of superheat, or preferably both. By adopting higher pressure and superheat the gain in turbine efficiency, theoretically and in practice, is very marked.

Efficiency of a Turbine.

The efficiency of a turbine is the ratio of the mechanical energy taken out of the steam by the turbine to the total energy in the supplied steam, when this steam is expanded adiabatically from the pressure at the throttle valve to the exhaust pressure in the exhaust casing of the turbine.

The steam consumption of a turbine, when connected to an electric generator, is generally stated in pounds of steam per kilowatt-hour, and is the amount of steam required to deliver one kilowatt for one hour.

"Theoretical water-rate" is a term constantly used in all turbine investigations and is the ratio of one kilowatt-hour expressed in foot-pounds (2,654,000) to the available energy of one pound of steam expressed in foot-pounds. The ratio between the theoretical water-rate and the actual measured water-rate, gives the efficiency of the turbine. The accompanying table shows the theoretical water rates per kilowatt-hour (Table I) at the steam pressures, superheats, and vacua generally used.

Formula for Calculation of Available Energy.

The formula for calculating the available energy of steam expressed in foot-pounds, either dry or superheated, when expanding adiabatically to any back pressure, is seldom found in handbooks or textbooks, and when such formulas are found they are rather complex and difficult to use. The formula can, however, be made very simple when expressed as the difference between the total heat input and the heat left in the liquid together with the latent heat in the mixture at the lower pressure. The formula then becomes:

Available energy in ft.-lb. =

$$778[H_1 + C_p t_1 - (q_2 + x_2 r_2)]$$

where H_1 = total heat of saturated steam at initial pressure p_1

C_p = specific heat of superheated steam

t_1 = deg. F. superheat at present p_1

q_2 = heat of the liquid at lower pressure p_2

x_2 = quality of the steam at pressure p_2

r_2 = latent heat at pressure p_2.

All of these quantities are found in any steam table except x_2 (dryness factor), which is, however, easily calculated from the fact that the entropy is constant before and after the expansion.

Entropy of superheated steam is:

$$C_p \log_e \frac{T_1+t_1}{T_1} + \frac{r_1}{T_1} + \phi_1$$

Entropy of moist steam is:

$$\frac{X_2 r_2}{T_2} + \phi_2$$

By making these equal and solving for x_2 there results:

$$x_2 = \frac{T_2}{r_2}\left(C_p \log_e \frac{T_1+t_1}{T_1} + \frac{r_1}{T_1} + \phi_1 - \phi_2\right)$$

T_1 = absolute temperature at pressure p_1

T_2 = absolute temperature at pressure p_2

ϕ_1 = entropy of water at pressure p_1

ϕ_2 = entropy of water at pressure p_2

Example: Find the available energy of one pound of steam when expanding from 250 lb. gauge pressure, with 250 deg. superheat, to 29 in. vacuum, (0.5 lb. abs.)

Available energy $= 778[H_1 + C_p t_1 - (q_2 + x r_2)]$

$H_1 = 1202.3$

$C_p = 0.553$

$t_1 = 250$

$q_2 = 48$

$r_2 = 1046.7$

$$x_2 = \frac{T_2}{r_2}\left(C_p \log_e \frac{T_1+t_1}{T_1} + \frac{r_1}{T_1} + \phi_1 - \phi_2\right)$$

$T_1 = 461 + 406.2 = 867.2$

$t_1 = 250$

$r_1 = 821.6$

$\phi = 0.5739$

$r_2 = 1046.7$

$T_2 = 461 + 80 = 541$

$\phi_2 = 0.0932$

$$x_2 = \frac{541}{1046.7}\left(0.553 \log_e \frac{1117.2}{867.2} + \frac{821.6}{867.2} + 0.5739 - 0.0932\right)$$

$$= \frac{541}{1046.7}\left(0.553 \times 0.2546 + 0.947 + 0.5739 - 0.0932\right)$$

$= 0.5168 \times 1.5685 = 0.812$

Dryness factor $= 0.812$

Available energy =

$778\ [1202.3 + 0.553 \times 250 - (48 + 0.812 \times 1046.7)] = 778 \times 444.3 = 346{,}000$ ft.-lb.

[Theoretical water rate per kw.-hr. $= 2{,}654{,}000/346{,}000 = 7.67$ lb.]

The theoretical gain obtainable by the use of higher steam pressures is brought out in the table on page 445 (Table II). This table shows that 1 lb. of dry steam at 200 lb. pressure expanded to 28.5 in. of vacuum is considered unity. By raising the boiler pressure to 500 lb. a saving in fuel of 14.43 per cent accrues. This saving would amount to about $200,-

000 a year in a plant burning about 130 tons a day with coal at $5 a ton.

The theoretical gain in turbine performance resulting from increasing the superheat is shown in the Table III on the basis of 250 lb. gauge expanded to 29-in. vacuum. This table shows that the gain, theoretically, is comparatively small due superheat, being in fact 2.9 per cent when superheating up to 300 deg. F. However, the practical advantages accompanying superheating must be added to the theoretical. It is commonly stated that the water-rate of a turbine is reduced 1 per cent for definite number of degrees of superheat. The figure ordinarily taken for this is 1 per cent reduction in water-rate per 12.5 deg. F. increase in superheat. This value varies with various designs of turbines, but the value is sufficiently close for present purposes. On this assumption the per cent increase in available energy due superheating in

TABLE I

THEORETICAL WATER RATES PER KILOWATT HOUR

(Heat values from Marks & Davis' Steam Tables)

Sat. Deg. F.	26 in.	27 in.	27.5 in.	28 in.	28.5 in.	29 in.	26 in.	27 in.	27.5 in.	28 in.	28.5 in.	29 in.
	150 LB. GAUGE						160 LB. GAUGE					
0	11.80	11.23	10.92	10.55	10.12	9.59	11.66	11.10	10.79	10.43	10.01	9.50
25	11.61	11.05	10.74	10.38	9.96	9.44	11.45	10.91	10.61	10.26	9.85	9.34
50	11.42	10.87	10.58	10.22	9.81	9.30	11.28	10.75	10.45	10.11	9.70	9.21
75	11.24	10.71	10.41	10.07	9.66	9.17	11.10	10.58	10.29	9.95	9.56	9.07
100	11.07	10.55	10.26	9.92	9.52	9.03	10.92	10.41	10.13	9.80	9.42	8.94
125	10.90	10.38	10.10	9.77	9.38	8.90	10.75	10.25	9.98	9.66	9.27	8.81
150	10.75	10.23	9.96	9.63	9.25	8.78	10.60	10.10	9.84	9.52	9.15	8.69
	165 LB. GAUGE						170 LB. GAUGE					
0	11.57	11.03	10.73	10.37	9.96	9.45	11.50	10.96	10.66	10.32	9.91	9.40
25	11.39	10.84	10.55	10.20	9.80	9.30	11.31	10.78	10.49	10.15	9.75	9.25
50	11.20	10.68	10.39	10.05	9.65	9.16	11.13	10.61	10.33	9.99	9.60	9.11
75	11.02	10.50	10.22	9.89	9.50	9.02	10.95	10.45	10.17	9.84	9.45	8.98
100	10.85	10.35	10.06	9.75	9.37	8.89	10.79	10.29	10.02	9.70	9.32	8.85
125	10.68	10.18	9.92	9.60	9.23	8.76	10.62	10.13	9.86	9.55	9.18	8.73
150	10.52	10.04	9.77	9.46	9.10	8.64	10.47	9.99	9.73	9.42	9.05	8.60
	175 LB. GAUGE						180 LB. GAUGE					
0	11.44	10.91	10.61	10.27	9.87	9.36	11.37	10.85	10.56	10.22	9.82	9.31
25	11.25	10.72	10.44	10.10	9.70	9.21	11.18	10.67	10.38	10.05	9.66	9.17
50	11.07	10.55	10.27	9.94	9.55	9.07	11.01	10.50	10.22	9.89	9.51	9.03
75	10.89	10.39	10.11	9.79	9.41	8.94	10.84	10.34	10.06	9.74	9.37	8.90
100	10.72	10.23	9.96	9.64	9.27	8.81	10.66	10.17	9.90	9.60	9.22	8.77
125	10.55	10.07	9.81	9.50	9.13	8.68	10.49	10.02	9.76	9.46	9.09	8.65
150	10.40	9.92	9.67	9.37	9.00	8.56	10.34	9.87	9.61	9.32	8.96	8.53
	185 LB. GAUGE						190 LB. GAUGE					
0	11.31	10.79	10.51	10.17	9.77	9.28	11.25	10.74	10.46	10.12	9.73	9.25
25	11.12	10.61	10.33	10.00	9.61	9.13	11.06	10.56	10.28	9.96	9.58	9.10
50	10.94	10.44	10.17	9.84	9.46	8.99	10.88	10.39	10.12	9.80	9.42	8.96
75	10.77	10.28	10.02	9.69	9.32	8.86	10.71	10.23	9.97	9.65	9.28	8.82
100	10.60	10.12	9.86	9.55	9.19	8.73	10.55	10.08	9.82	9.51	9.15	8.70
125	10.43	9.97	9.72	9.41	9.06	8.61	10.39	9.92	9.67	9.37	9.01	8.58
150	10.28	9.82	9.57	9.27	8.92	8.49	10.23	9.77	9.53	9.24	8.88	8.46
	195 LB. GAUGE						200 LB. GAUGE					
0	11.20	10.69	10.41	10.08	9.69	9.22	11.15	10.64	10.37	10.04	9.66	9.18
25	11.01	10.51	10.24	9.92	9.53	9.07	10.96	10.46	10.19	9.87	9.49	9.03
50	10.83	10.35	10.08	9.76	9.38	8.92	10.77	10.29	10.03	9.71	9.34	8.88
75	10.66	10.18	9.92	9.61	9.24	8.79	10.61	10.13	9.87	9.57	9.20	8.75
100	10.50	10.03	9.77	9.47	9.11	8.66	10.44	9.97	9.72	9.42	9.06	8.62
125	10.33	9.87	9.62	9.32	8.97	8.54	10.28	9.82	9.57	9.28	8.93	8.50
150	10.18	9.72	9.48	9.18	8.84	8.42	10.13	9.68	9.44	9.15	8.81	8.39
200	9.86	9.43	9.19	8.92	8.59	8.18	9.81	9.39	9.15	8.88	8.55	8.15
	205 LB. GAUGE						210 LB. GAUGE					
0	11.09	10.60	10.32	9.99	9.62	9.15	11.04	10.55	10.28	9.97	9.59	9.12
25	10.90	10.41	10.14	9.82	9.45	8.99	10.85	10.37	10.10	9.79	9.42	8.96
50	10.72	10.24	9.98	9.67	9.30	8.85	10.68	10.20	9.94	9.63	9.27	8.82
75	10.55	10.09	9.83	9.52	9.17	8.72	10.50	10.04	9.78	9.48	9.13	8.69
100	10.39	9.93	9.68	9.38	9.03	8.59	10.34	9.89	9.63	9.34	9.00	8.56
125	10.23	9.78	9.54	9.24	8.90	8.47	10.19	9.75	9.49	9.21	8.87	8.44
150	10.08	9.64	9.39	9.11	8.77	8.35	10.03	9.60	9.35	9.07	8.74	8.32
200	9.77	9.35	9.11	8.84	8.53	8.12	9.73	9.31	9.08	8.81	8.49	8.10
	215 LB. GAUGE						220 LB. GAUGE					
0	11.00	10.51	10.24	9.93	9.55	9.09	10.95	10.47	10.20	9.89	9.52	9.06
25	10.79	10.32	10.05	9.75	9.38	8.93	10.75	10.28	10.02	9.71	9.35	8.90
50	10.62	10.16	9.89	9.59	9.24	8.79	10.58	10.11	9.85	9.55	9.20	8.76
75	10.46	10.00	9.74	9.44	9.09	8.66	10.41	9.95	9.70	9.40	9.06	8.63
100	10.30	9.85	9.60	9.30	8.96	8.53	10.24	9.80	9.55	9.26	8.93	8.50
125	10.14	9.70	9.46	9.16	8.83	8.41	10.09	9.66	9.42	9.13	8.80	8.38
150	9.98	9.55	9.31	9.03	8.71	8.29	9.94	9.52	9.28	9.00	8.67	8.27
200	9.68	9.27	9.04	8.77	8.46	8.06	9.64	9.23	9.00	8.74	8.42	8.03
	225 LB. GAUGE						230 LB. GAUGE					
0	10.90	10.42	10.15	9.85	9.48	9.03	10.86	10.39	10.12	9.82	9.45	9.00
25	10.71	10.24	9.98	9.67	9.32	8.87	10.66	10.20	9.94	9.64	9.28	8.84
50	10.53	10.07	9.81	9.52	9.17	8.73	10.48	10.03	9.78	9.48	9.13	8.70
75	10.36	9.91	9.66	9.37	9.03	8.60	10.32	9.87	9.63	9.34	8.99	8.57
100	10.20	9.76	9.52	9.23	8.90	8.47	10.16	9.72	9.48	9.20	8.86	8.44
125	10.05	9.62	9.38	9.10	8.77	8.35	10.01	9.58	9.34	9.06	8.74	8.33
150	9.90	9.47	9.24	8.96	8.64	8.23	9.86	9.44	9.20	8.93	8.61	8.21
200	9.60	9.20	8.97	8.71	8.40	8.01	9.56	9.16	8.93	8.67	8.37	7.98
	235 LB. GAUGE						240 LB. GAUGE					
0	10.81	10.35	10.09	9.78	9.42	8.96	10.76	10.31	10.06	9.75	9.39	8.94
25	10.64	10.15	9.90	9.60	9.25	8.81	10.57	10.12	9.88	9.57	9.22	8.78
50	10.44	9.99	9.75	9.45	9.10	8.67	10.38	9.95	9.70	9.41	9.07	8.64
75	10.27	9.83	9.59	9.30	8.96	8.54	10.23	9.79	9.55	9.26	8.93	8.51
100	10.12	9.68	9.45	9.17	8.83	8.42	10.08	9.65	9.41	9.13	8.80	8.39
125	9.96	9.54	9.30	9.03	8.70	8.29	9.92	9.50	9.27	9.00	8.67	8.27
150	9.81	9.40	9.16	8.90	8.58	8.18	9.77	9.36	9.13	8.86	8.55	8.15
200	9.52	9.12	8.90	8.64	8.33	7.95	9.48	9.09	8.87	8.61	8.31	7.93
	245 LB. GAUGE						250 LB. GAUGE					
0	10.73	10.27	10.01	9.71	9.35	8.91	10.69	10.23	9.98	9.68	9.33	8.89
25	10.53	10.08	9.83	9.53	9.18	8.78	10.49	10.04	9.79	9.49	9.15	8.72
50	10.35	9.91	9.67	9.36	9.04	8.61	10.31	9.87	9.63	9.34	9.01	8.59
75	10.19	9.76	9.52	9.22	8.90	8.48	10.15	9.72	9.48	9.20	8.87	8.46
100	10.03	9.61	9.37	9.09	8.77	8.36	9.99	9.57	9.34	9.07	8.74	8.34
125	9.88	9.47	9.23	8.96	8.64	8.24	9.84	9.43	9.20	8.93	8.61	8.22
150	9.73	9.33	9.10	8.83	8.52	8.12	9.69	9.29	9.06	8.80	8.49	8.10
200	9.43	9.04	8.82	8.57	8.27	7.90	9.41	9.02	8.80	8.55	8.25	7.88

TABLE II.

THEORETICAL GAIN IN FUEL BY INCREASING STEAM PRESSURE.

Absolute pressure, lb.	Corresponding temperature, deg. F.	Total heat.	Increase in total heat, per cent.	Available energy in ft.-lb. expanding to 28.5 in vacuum.	Increase of available energy, per cent.	Net gain in fuel, per cent.
200	381.9	1198.5	....	272,000	....	....
300	417.5	1201.9	0.28	293,000	7.72	7.44
400	444.8	1202.5	0.33	304,500	11.95	11.62
500	467.2	1201.7	0.27	312,000	14.7	14.43
600	486.5	1199.8	0.11	319,000	17.2	17.09
700	503.4	1197.4	0.902	323,000	18.7	18.79
800	518 5	1194.4	—0.342	327,000	20.2	20.54
900	532.3	1191.1	—0.617	329,000	20.9	21.51
1000	545.0	1187.6	—0.909	331,000	21.7	22.6

Table III is based. There is, of course, considerable saving in the size of auxiliaries by the use of superheat, but this is outside the scope of this article.

Examination of the last column in Table III shows that the actual net gain in fuel saving is 4.67 per cent with 150 deg. superheat and 10.45 per cent with 300 deg. superheat.

The magnitude of the losses in a well-designed turbine of the impulse type are about as follows:

	Per cent.
Loss due to friction in nozzles and blades and windage loss of disks and blades	20
Leakage loss	3
Rejected energy (due to residual steam velocity)	3
Bearings, packing, etc.	1
Total losses	27
Efficiency of turbine	73

Friction loss in nozzles and blades, windage in disks and blades is seen to be the chief loss. And it is this loss that superheat reduces so effectively, as

TABLE III.

EFFECT OF SUPERHEATING STEAM WHEN WORKING BETWEEN 250 LB. GAUGE AND 29 IN. VACUUM.

Degree superheat.	Temperature, deg. F.	Total available energy per lb. of steam.	Total B.t.u. per lb.	Per cent increase in coal to produce superheat.	Per cent increase available energy due to superheat.	Net theoretical gain, per cent.	Actual gain, per cent.	Actual net gain, per cent.
(1)		(2)	(3)	(4)	(5)	(6) = (5—4)	(7)	(8) = (7—4)
0...	406	298,000	1202.3	....	....	....	....	....
50...	456	308,500	1237.0	2.89	3.53	0.64	4.00	1.11
100...	506	318,000	1264 6	5.18	6.72	1.54	8.00	2.82
150...	556	327,500	1290 5	7.33	9.90	2.57	12.00	4.67
200...	606	336,000	1315.6	9.45	12.75	3.30	16 00	6.55
250...	656	341,500	1340.5	11.50	14.60	3.10	20.00	8.50
300...	706	347,000	1365.3	13.55	16.45	2.90	24.00	10.45

brought out in Table III where the practical gain by superheating is about two and one-half times the theoretical. The use of steam superheated to 200 deg. F. will reduce the friction loss about 25 per cent, so that the total loss from this cause will be 15 per cent instead of 20 per cent, making the total turbine loss 22 per cent instead of 27 as given in the table of losses, and bringing the turbine efficiency up to 78 instead of 73 per cent.

Effect of Moisture on Friction.

A great many formulas and curves are given by various authors based upon experimental and theoretical data for calculating the friction losses, and they all have a constant which varies according to the conditions of the steam. Prof. Moyer, for example, in his book on steam turbines gives a formula for

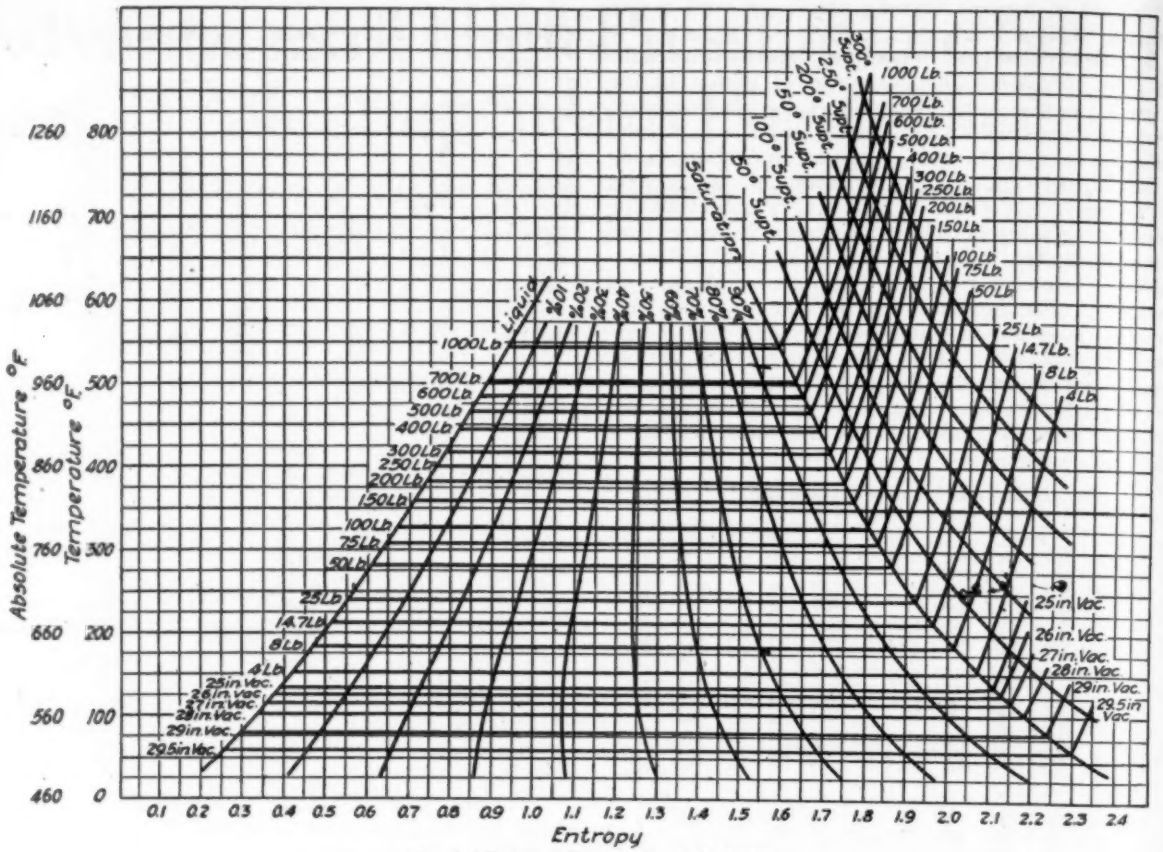


Fig. 1.—Entropy-Temperature Diagram.

rotation losses of buckets and wheel disks in which the constant is as follows:

	Constant.
100 deg. superheat	0.875
50 deg. superheat	0.93
0 deg. superheat	1.00
5 per cent moisture	1.08
10 per cent moisture	1.25
20 per cent moisture	2.00

In Fig. 2 is shown diagrammatically the comparison of the steam in each stage of a ten-stage turbine using dry steam and steam superheated to 250 deg. F. The assumption is made in this instance that the turbine has an efficiency of 80 per cent with steam at 250 lb. pressure and 29-in. vacuum.

High steam pressure without superheat possesses the very great disadvantage of producing an increased amount of moisture throughout the turbine. This can be seen by referring to the entropy-temperature curves in Fig. 1, which emphasizes the benefits of

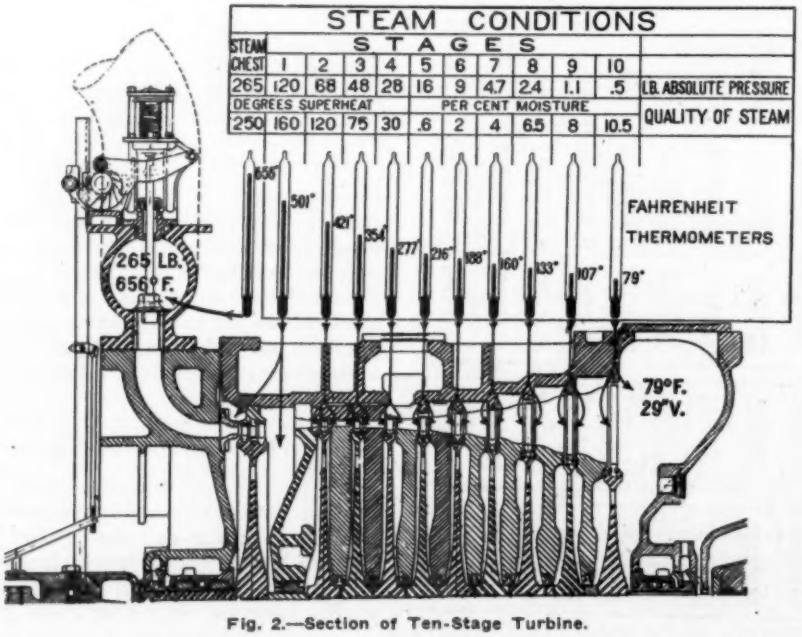

STEAM CONDITIONS
STAGES
STEAM CHEST 1 2 3 4 5 6 7 8 9 10
265 120 68 48 28 16 9 4.7 2.4 1.1 .5 LB. ABSOLUTE PRESSURE
DEGREES SUPERHEAT PER CENT MOISTURE
250 160 120 75 30 .6 2 4 6.5 8 10.5 QUALITY OF STEAM
656° 501° 421° 354° 277° 216° 188° 160° 133° 107° 79°
FAHRENHEIT THERMOMETERS
265 LB. 656° F.
79° F. 29" V.

Fig. 2.—Section of Ten-Stage Turbine.

superheating the steam with increasing pressures, so as to obtain maximum efficiency. The curves in Fig. 3 show the gain by combining the use of high pressure and superheat. These curves give the ratio of available B.t.u.'s in steam to total heat in steam for various pressures and superheat, when returning feedwater at 90 deg. temperature. These curves thus show the gain accruing from higher steam pressures and superheat.

With steam pressure of 200 lb. gauge, 150 deg. superheat, equivalent to a temperature of 538 deg., and a vacuum of 28.5 in., the present practice of turbine stations in this country, the ratio of maximum available heat for work to the total heat is only about 31.25 per cent. In Europe, on the other hand, steam temperatures as high as 700 deg. F. are now used, which corresponds to a steam pressure of 500 lb. and 233 deg. superheat, giving a ratio of available heat of about 36.3 per cent. This higher ratio of heat available permits a fuel saving of 16 per cent compared with conditions in this country.

Statements have frequently been made that because throttling dry steam produces superheat practically no loss occurs due to throttling. This is true as far as heat loss is concerned, but is not true as concerns energy. There is in fact a considerable energy loss due to throttling, which may be readily calculated since the total heat before and after throttling is the same. Assuming that steam at 200 lb. absolute is throttled down to 100 lb. absolute:

Total heat of dry steam at 200 lb. abs. = 1198.1.

Total heat of dry steam at 100 lb. abs. = 1186.3.

Assume the specific heat of steam as 0.5, then,

$1198.1 = 1186.3 + 0.5 \times t_1$ (where t_1 is the degree of superheat) = 23.6 deg.

The available energy, however, assuming that the steam in both cases is expanded to 28.5 in. vacuum is,

With 200 lb. pressure, dry steam = 270,800 ft.-lb.

With 100 lb. pressure, 23.6 deg. superheat = 240,200 ft.-lb.

The loss in available energy due throttling is thus found to be about 11 per cent.

Turbogenerators are now being built with an overall efficiency of more than 80 per cent. With a boiler efficiency of 80 per cent the efficiency from fuel amounts to 23.25 per cent ($36.3 \times 0.80 \times 0.80$). As a kilowatt-hour equals 3412 B.t.u., the B.t.u. required to produce one kilowatt-hour at the switchboard is expressed by

$$\frac{3412}{0.2325} = 14{,}600$$

Had a pressure of 800 lb. and 800 deg. temperature been used instead of 200 lb. and 150 deg. superheat, the efficiency would have been 38.75 per cent. Using a turbine of 85 per cent efficiency, and a boiler with 88 per cent efficiency, as is possible when using preheated air, forced draft and liquid fuel, a kilowatt-hour could be obtained by

$38.75 \times 0.85 \times 88 = 29$ per cent or

$$\frac{3412}{0.29} = 11{,}750 \text{ B.t.u.}$$

This is equivalent to

$$\frac{11{,}750}{19{,}000} = 0.62 \text{ lb. of fuel oil.}$$

The advocates of Diesel engines are claiming about 0.55 lb. of fuel oil per kilowatt-hour. This is, however, obtained only with a fuel about 50 per cent higher in price than that which can be satisfactorily burned under a boiler. It can be seen that when full advantage is taken of higher superheat and pressure in transforming the energy of fuel into mechanical energy through the medium of steam, there will be, and are being now, obtained results that compare favorably with internal-combustion engines.

The above paper was presented before a meeting of Chicago Sections, American Institute of Electrical Engineers, American Society of Mechanical Engineers and Western Society of Engineers.

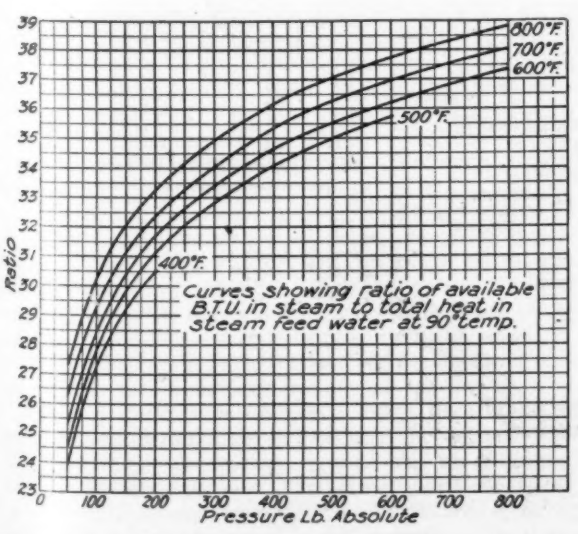


Fig. 3.—Curves Showing Gain in Turbine Performance Due to Combined Superheat and Pressure Increase.

ILLUMINATING ENGINEERING SOCIETY CONVENTION.

The annual convention of the Illuminating Enginering Society will be held this year in the Enginering Societies Building in New York City on October 10. The entire technical program will be confined to one day instead of four days, as was the custom before the war. All presentations and discussions will, therefore be in condensed form. The evening of October 10 will be given over to a dinner-meeting at which speakers of national prominence will discuss questions pertaining to the war and illumination. The tentative program for the day sessions is as follows:

Morning Session.—Registry and assembly; annual business meeting; presidential address, by A. E. Kennelly; report of Committee on Progress; report of Committee on Nomenclature and Standards of International Commission on Illumination, by E. P. Hyde; "The New York State Automobile Headlight Law," by F. M. Hugo; report of Committee on Automobile Headlighting Specifications, by C. H. Sharp; report of Committee on Lighting Legislation and statement concerning work of Divisional Lighting Committee, by L. B. Marks; statement concerning War Committee of Technical Societies, by D. W. Brunton; report of Committee on War Service, by P. S. Millar; four-minute Liberty Loan talk.

Afternoon Session.—"Lighting of Cantonments," by Bassett Jones; "War-Time Lighting Economies," by Committee on War Service; "Light as a Manufacturing Stimulant," by W. A. Durgin; "Protective Lighting," by Edmund Leigh; "Influence of Lighting Curtailment Upon Accident Hazards," by R. E. Simpson; "Plan for Insuring Quality of Industrial Reflectors," by Ward Harrison.

Smokeless Combustion With Chain-Grate Stokers

Discussion of Furnace Chambers, Boiler Settings and Baffling as Affecting Efficiency and Smokeless Combustion of High-Volatile Coals Before the Annual Smoke Prevention Convention, Newark, N. J.

By THOMAS A. MARSH

Chief Engineer, Green Engineering Company.

THE chain grate has been in the field since 1871 in this country and furnace designs giving smokeless installations under the many varied conditions are quite definitely established among combustion engineers. Chain-grate manufacturers and their engineers have taken an active part in the development work which has led to this satisfactory situation, having first devoted efforts in this direction some fifteen years ago. This was prior to the existence of a large number of our present types of stokers, as well as to the establishment of but a very few organized smoke departments.

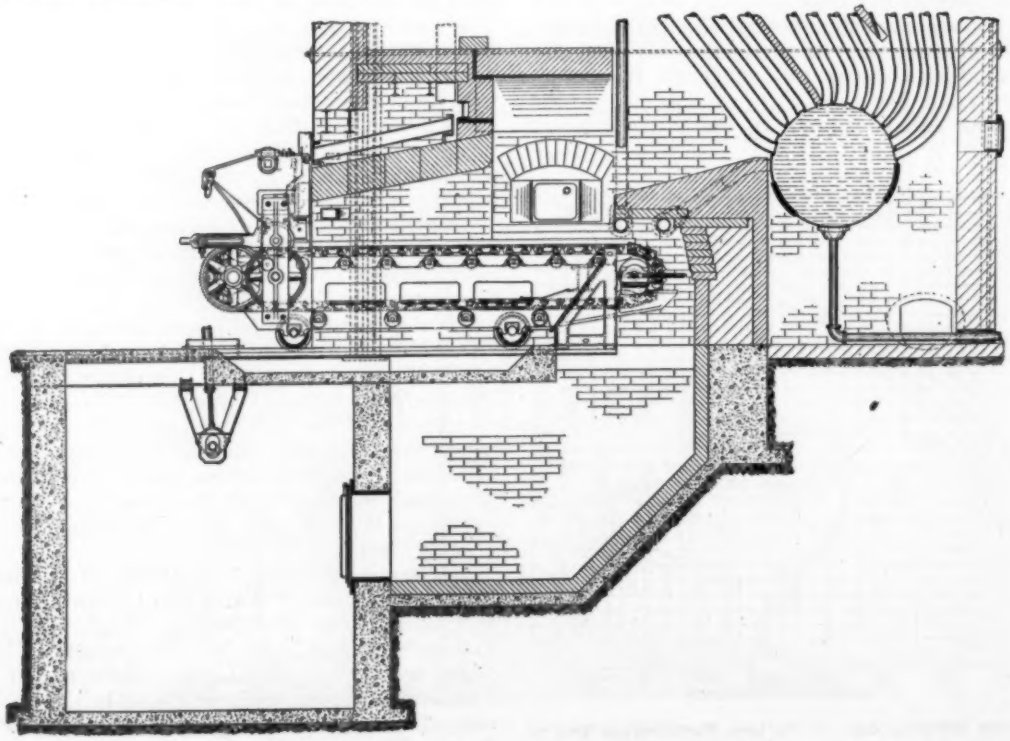
In the early days, the bulk of chain-grate installations were greatly lacking in proper furnace proportion and design, but in spite of the fact that these initial stokers were set directly under the boilers, observations brought out two significant facts. The first, that even in the absence of adequate furnaces, chain grates were good performers from a smokeless standpoint; and second, boiler tests indicated high hydrocarbon losses, due to insufficient space for proper combustion.

The campaign for setting boilers higher to provide ample furnace space for more complete combustion was most difficult. Engineers, architects, owners and others disapproved on account of the extra cost, and it was not until city smoke departments, backed by city ordinances, began to exert influence that the problem was simplified. For instance, the Chicago Smoke Department is very specific regarding boiler height and furnace proportions, as are such departments in other cities.

From year to year furnace volume has increased. Ten years ago furnaces with 2 cu. ft. per unit grate area were common; today, we have furnaces providing as high as 20 cu. ft. per square foot of grate area, while those having 6 to 8 cu. ft. are the general rule. It is becoming quite a necessity to discuss furnaces in terms of cubic feet per square foot of grate surface.

Let us consider how these large furnaces affect their settings. Ten years ago, vertically baffled boilers of the B. & W. type were often set as low as 7 ft. from the floor line to the bottom of the header. Now 12 ft. is considered none too great, although this type of boiler with chain grates will perform within the Chicago ordinance at 200 per cent rating when set only 9 ft. under header. Accordingly, this large furnace is not provided entirely to secure smokelessness.

Boilers baffled horizontally and set 7 ft. under the header will give similar results, and boilers of the

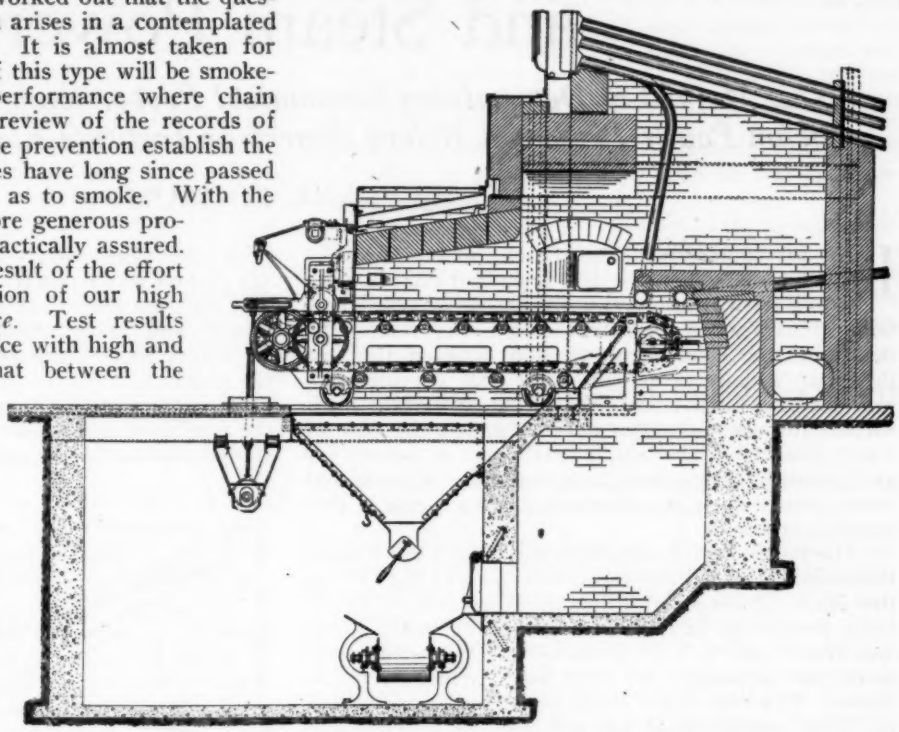


Chain-Grate Stoker Installed Under Stirling Boiler.

return tubular type, set 6 ft. 6 in. to the bottom of the shell, as well as Stirling boilers set 3 ft. 6 in. to the center line of drum, are equally smokeless.

This problem is so well worked out that the question of smokelessness seldom arises in a contemplated installation of chain grates. It is almost taken for granted that an installation of this type will be smokeless. Careful checking of performance where chain grates are in service and a review of the records of the various bureaus for smoke prevention establish the fact that chain-grate furnaces have long since passed the point of being uncertain as to smoke. With the present boiler settings of more generous proportions, smokelessness is practically assured.

High-set boilers are the result of the effort to secure complete combustion of our high volatile coals *in the furnace*. Test results taken through years of practice with high and low set boilers indicate that between the heights of 7 to 10 ft. on vertically baffled boilers there is fully a 12 per cent difference in efficiency in the favor of the latter. This difference may be credited solely to a more complete combustion of the hydrocarbon gases. Engineers are realizing rapidly this fact, and better furnace designs are coming. Smokeless combustion was the first inducement that has led to the general discovery of the improved efficiency obtainable. It is well said that while smoke is not, in itself, a great loss, it is almost invariably the tell-tale indicator of other reprehensible plant conditions which entail losses often as high as 20 per cent.



Chain-Grate Stoker Installation Under Vertically-Baffled Water-Tube Boiler.

Fuels.

The fuels which are customarily burned on chain grates are the bituminous, tarry, smoky coals which, without question, are under improper conditions the worst smoke producers obtainable. Chain grates are well adapted, fortunately, to these fuels, and smokeless combustion is easily to be derived. In the words of W. L. Abbott, chief engineer, Commonwealth Edison Company, Chicago, "Illinois and Indiana coals were originated to be burned on chain grates." Certainly, smokelessness is easily obtained even with such fuels, with proper furnaces and chain grates. The necessary dimensions to insure smokelessness with chain grates are standard in most of our cities. Arch designs, air distribution and air exclusion and other features are improving.

At one time an efficiency of 72 to 75 per cent with chain grates and western coals was considered impossible. Today such results are obtained repeatedly with proper furnace designs. Such results are due to complete combustion in the furnace. Stokers, in many instances, have been accused of being responsible for low economy, when as a matter of fact the loss was due entirely to a deficiency in furnace space.

Many eastern coals, due to a lower percentage of volatile hydrocarbons, do not require the furnace volume demanded by western coals. As an example, compare Pocahontas and New River, with 12 to 14 per cent volatile matter, with Pittsburgh No. 8, at 35 per cent, or more than double the amount. Yet there has been no discrimination of furnace to burn this greatly increased percentage of volatile. Illinois and Indiana coals have 35 per cent volatile, and some Colorado coals have close to 60 per cent of volatile.

Recommendations.

The general message, therefore, to be impressed is:

(1) Learn to analyze furnaces as to the number of cubic feet of furnace per square foot of grate.

(2) High moisture fuels, sub-bituminous, lignite and Iowa high-ash coals are now being burned successfully in many plants on chain grates, the problem simply being one of furnace design.

(3) There are comparatively few boiler settings existing today which could not have their efficiency improved several per cent with no change in apparatus but by increasing the proportions of the furnaces.

(4) Engineers should realize that departments of smoke prevention are asking for the minimum dimensions to insure smokelessness; frequently an appreciable improvement in efficiency will be obtained by installing still more ample furnaces. Best practice is in this direction.

(5) The general plea, therefore, is for more ample furnaces and the higher efficiencies beyond the minimum required for smokelessness.

IDAHO POWER HAS ADDED SIX UNITS AND BUILT A 72-MILE EXTENSION.

Among the improvements made this year by Idaho Power Company was the extension of a 66,000-volt transmission line from its plant at 1000 Springs, on Snake River, 72 miles to Jarbidge, Nev., to serve the mine and concentrating mill of Elkoro Mines Company, which requires 700 hp. The Idaho Power Company installed six new power units this year, aggregating 10,500 kw.

Economic Proportion of Hydroelectric and Steam Power

New Method of Determining Economical Proportion of Hydroelectric to Steam Power Presented Before American Institute Electrical Engineers

By FRANK G. BAUM

IT IS, of course, well known that steam power is usually less expensive for low load-factors than hydroelectric power, and the latter becomes economical only when the load-factor is favorable. To determine the economical division between the two there are usually given curves of cost varying with load-factor. Such curves show that at certain load-factors the cost of steam power exceeds the cost of water power, but the actual yearly cost of power for any assumed proportion between water power and steam power must be calculated for each case. This becomes laborious.

The results can, however, be shown in a much more illuminating way if presented as shown in Fig. 1. In this figure, abscissas from left to right (from O to O) show percentage of total load carried by water power and from right to left (from O^1 to O) the abscissas show the percentage of total load carried by steam power. The sum of the steam power and water power must, of course, equal 100 per cent for every condition, hence the sum of the two abscissas is 100 per cent at any point.

If now the yearly cost per kilowatt of hydroelectric power is taken as $O^1 h$, taken in the figure at $22 per kilowatt-year, and the straight line $O h$ is drawn, this line will represent by any ordinate the yearly charge per kilowatt against the water power for any proportion between steam and water power. For it is clear that if we have one-half water power then the yearly charge per kilowatt against the entire 100 per cent load is $11. (In comparing the cost of power total cost of delivery to center of load must, of course, be included.)

Similarly, if the yearly fixed cost per kilowatt of steam power is taken as $O s$, taken in the figure as $11 per kw.-year, and the line $O^1 s$ is drawn, this will represent by any ordinate the yearly charge per kilowatt against the steam power for any proportion between steam and water power.

The straight line $s h$ then represents the total fixed charge against the steam and hydroelectric power for any proportion of steam and water power. ($O h$ and $O^1 s$ being straight lines and $s h$ being derived by adding the ordinates, gives another straight line.)

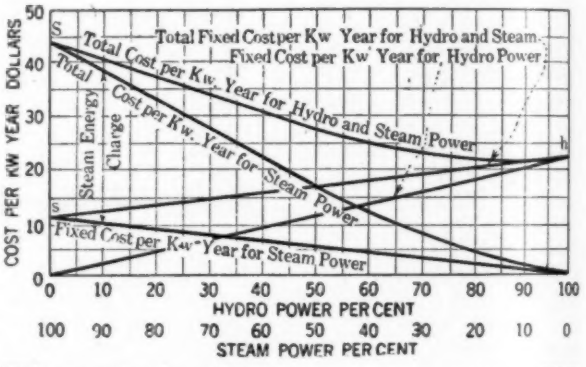
For example, let total load equal 100,000 kilowatts, divided 70 per cent hydroelectric and 30 per cent steam; then the yearly charge against the water power and steam will be

Water power, fixed charge	70,000 kw.	× $22	$1,540,000
Steam power, fixed charge	30,000 kw.	× 11	330,000
Total power, fixed charge			$1,870,000

or $18.70 per kw.-year, as shown by the ordinate of the line $s h$ at 70 per cent water power, 30 per cent steam power. All water power fixed charge would cost $2,200,000 and all steam power fixed charge $1,100,000 per year. All steam power costs $4,400,000.

For any other assumption of cost per year of water power or steam power, it is only necessary to determine the yearly fixed charge against steam power ($O s$) and water power ($O h$) and draw the line $s h$, and the total fixed charge for any proportion of water power and steam power is immediately obtained. This very much simplifies the problem and visualizes the results.

To determine the total charge per kw.-year against the combined steam and water power, it is necessary to add the kw-hr. charge against the steam power.


COST PER KW YEAR DOLLARS
50
40
30
20
10
0
S
Total Fixed Cost per Kw Year for Hydro and Steam
Fixed Cost per Kw Year for Hydro Power
Total Steam Energy Charge
Cost per Kw. Year for Hydro and Steam Power
Cost per Kw. Year for Steam Power
s
h
Fixed Cost per Kw Year for Steam Power
0 10 20 30 40 50 60 70 80 90 100
HYDRO POWER PER CENT
100 90 80 70 60 50 40 30 20 10 0
STEAM POWER PER CENT

Water power cost per kw-yr.	$22.00
Steam, fixed cost per kw-yr.	11.00
Steam energy charge per kw-yr. and 100% load-factor	44.00

Fig. 1.—Proportion of Water Power to Steam Power.

(It is, of course, assumed that all charges against the water power are fixed charges.)

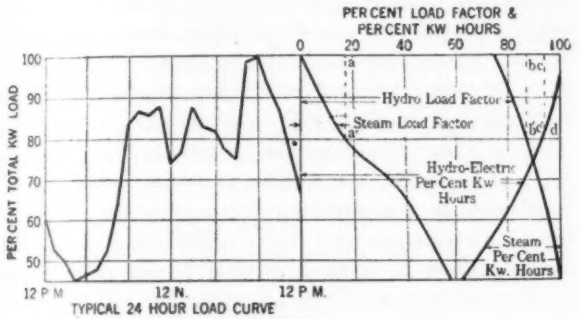
To determine the yearly charge against steam power for any load-factor we must start with the load curve of the power system. The load curve assumed is that shown on the left of Fig. 2. The ordinates, it will be noted, are plotted in percentage of the load, the peak load being 100 per cent.

Now the kw-hrs. carried by steam for any percentage of the total load carried by steam must be determined, it being assumed, of course, that the steam power takes the load off the top of the curve. For this purpose we determine the curve of kilowatt-hours to be carried by steam power when 10 per cent, 20 per cent, etc., of the top of the load curve is carried by steam. To do this we take the area of the load curve above 90 per cent for example, and determine what percentage this is of the entire area of the load curve. Similarly for areas above 80 per cent, 70 per cent, etc. The results are shown in the curves to the right of the load curve.

For example, if all load over 80 per cent is carried on steam, the steam load-factor = 17 per cent, and steam kilowatt-hours 6 per cent of the total as shown by $o a$ and $c^1 d$. Also a hydroelectric load-factor of 87 per cent and kilowatt-hours 94 per cent of the total as shown by $o b$ and $o c$ are obtained.

From the curves in Fig. 2 and the cost per kilowatt-hour of fuel and other strictly steam energy charges, is determined for any percentage of load carried by steam power the yearly energy charge per kilowatt-year. Assuming $33 per kilowatt-year for energy charge where all the energy is supplied by steam for the particular load curve under consideration (which corresponds practically to $44 per kilowatt-year, or 0.5 cent per kilowatt-hour for 100 per cent load-factor, as the load-factor of total load is 75 per cent) and adding the energy charge to the fixed charge for steam power, the total cost of steam power as shown by the curve "cost steam power" $O^1 S$ in Fig. 1 is derived.

To obtain now the total cost of all power for any proportion of steam power to water power, the ordinates of $o\ h$ the "fixed cost of hydroelectric power" are added to the ordinates $o^1 S$ the "Total cost of steam power" and obtain the curve $h\ S$ the "total cost



EXAMPLE.

For 20% peakload carried by steam and 80% by water the curves show

Steam load-factor = 17% = o a
Water load-factor = 17% = o b
Water kw-hr. = 94% = o c
Steam kw-hr. = 6% = c d

Note—Steam carries everything above 80% line in example, and the curves will show per cent load-factor and per cent kw-hours for any other per cent load taken.

Fig. 2.—Load-Factors for Kilowatt-hours for Steam and Water.

per kilowatt-year hydroelectric and steam power." This curve starts at $22 per kilowatt-year if all power is water power. By adding some steam power to take off the peaks, there is seen to be a slight decrease in the yearly charge until the steam power carries about 15 per cent of load. At 20 per cent of load the cost again comes to about $22 per year, and then a gradual increase in power cost results.

At 30 per cent load carried by steam for this particular load curve there is little difference in the yearly charge per kilowatt and installing less than 30 per cent steam would not in this case be warranted, for naturally, unless very material savings result, the decision will always be to install steam power because of the smaller capital cost.

At 50 per cent of total load taken by steam installation and 50 per cent by water power, the yearly charge is as follows:

50 per cent × $22	$11.00 yearly fixed charge water power
50 per cent × $11	$ 5.50 yearly fixed charge steam power
Total	$16.50 yearly fixed charge total power

At 50 per cent load-factor practically 33⅓ per cent of the kilowatt-hours are carried by steam and this adds the energy charge of $33 × 33⅓ per cent or $11. Therefore, the total yearly charge is $16.50 + $11 = $27.50, as shown by the curve $h\ S$ by the ordinate at 50 per cent. The added charge over all water power costs here is $5.50 per kw. year, but on a system with 100,000 kw., the yearly excess charge is $550,000, a very substantial sum.

The curve of total yearly power costs per kilowatt shows graphically what it is desired to know, and after the curve of energy cost of steam power at various load-factors is obtained total costs per kilowatt-year for any assumption of fixed cost of hydroelectric and steam power is very quickly made up. It is believed this method will assist engineers in their work. The actual proportion of steam to hydroelectric power will, of course, be somewhat influenced by service insurance conditions.

This paper is merely an outline of the general principles and gives the general method to follow. There are, of course, many details and different conditions in different sections of the country. It is hoped that the method presented will appeal to engineers and managers.

NORWEGIAN GOVERNMENT ADOPTS ELECTRIC TRUCKS.

Initial Fleet of Fifty Electric Trucks to Be Used for Food Distribution.

After careful investigation, the Norwegian Government has placed initial orders with American manufacturers for 50 heavy-duty electric trucks to be used in various communities for the distribution of food, which, in Norway, as elsewhere, is none too plentiful these days and which must not only be economically used, but must be also scientifically distributed to avoid waste and spoilage, and to assure minimum transportation costs.

Norway, in common with many other European countries, is faced with a gasoline famine, the fluid, when procurable, costing about $1 per gallon. As elsewhere, the horse has ceased to be an economic asset, at least in ordinary commercial applications. It is estimated that to feed a horse with grain for one year requires five acres of land, sufficient to support about eight persons. When in addition to such extravagant use of productive land, horse feed must be freighted vast distances across land and sea, using ship tonnage which is otherwise urgently required, the horse must necessarily be relegated to the "non-useful occupation" class.

The electric vehicle is the solution to these problems. Water-powers are plentiful in Norway, and current for electric vehicle charging is available in large quantities at small cost. The electric vehicle successfully competed with the "gas" car when gasoline cost 15 cents a gallon and current 5 and more cents per kilowatt-hour. The superiority of the "electric" in Norway is evident when gasoline, when available, costs a dollar or more per gallon, and current about 2 cents per kilowatt-hour. Besides, the electric vehicle possesses the advantages of not requiring skilled mechanical operators, simplicity enabling it to be successfully operated by young men, old men and women, not required or suitable for direct war duties, and who as a class work for minimum wages. Also the "electric" is very seldom out of repair and consequently does not require that degree of mechanical supervision and repair necessary to keep gasoline trucks in service. Also many Norwegian cities have adopted electric vehicles, large orders being placed with American manufacturers. Electric trucks are also being successfully operated by a number of commercial concerns, and demands for electric passenger cars are in excess of shipping facilities.

Editorial Comment

Higher Steam Pressure and Superheat

THE greater the heat drop in a turbine the greater the thermal efficiency. It is obvious, therefore, that to increase the efficiency of a steam-turbine plant, where a constant loss is inherent whatever the temperature and pressure, increasing the range of temperature and pressure is necessary. Extension of the lower range, namely, the vacuum, is fixed. If cooling towers are used, as obtains in many European plants, 2-in. to 1.5-in. absolute pressure is feasible. In many large plants, with ample cool condenser water, 0.5-in. absolute pressure is now being obtained, leaving no choice but to extend the working range of steam in the upward direction. This means using higher steam pressures, higher superheat, or, preferably, both.

Elsewhere in this issue Mr. Eskil Berg presents a strong case on behalf of higher steam pressures and superheat for steam turbines, which, by the way, applies to reciprocating engines also to less extent and with more and greater drawbacks to offset the many advantages.

Both steam pressures and superheat have been gradually going up with the evolution of the steam turbine, its development to capacities up to 50,000 and 70,000 kilowatts, and the continual striving for higher efficiencies and conservation of fuel. While the increase of the working range has gone on steadily, there are many who maintain the benefits of radical increase justifies hastening the day when these higher steam pressures and superheat shall be adopted. Here and abroad, those in favor of higher pressure and superheat advocate going at a jump to 700 or 800 deg. F. with a working pressure of 600 lb. per sq. in. as compared with a temperature of around 538 deg. F. with 200 lb. per sq. in., 150 deg. superheat as representing the average practice in turbine plants today. Several plants are in operation in England with steam temperatures of 700 deg. and 350 lb. gauge, with plants for 475 lb. gauge and temperature of 700 deg. in course of erection. In this country a very few plants are operating at between 300 and 350 lb. pressure and many more between 250 and 300 lb. Experience in these plants has shown that many of the difficulties looked for have failed to materialize.

Recognizing, as one does, the very real benefits of higher steam pressure and superheat, it appears at first sight surprising that they have not been more readily adopted. This is perhaps accounted for by the fact that the benefits of higher steam temperature, superheat and pressure are handicapped by higher costs for experimentation, apparatus and its evolution, coupled with certain conservatism. On the other hand, one seems warranted in asserting that existing designs of apparatus, and apparatus now existent, can with little difficulty be modified for operation at pressures of 350 to 400 lb. per sq. in. with the accompanying gains in economy and fuel conservation.

In adopting pressures and superheat above 400 lb. there will, of course, be many things requiring special attention on the score of efficiency and safety. Changes in boiler construction will doubtless come at these radically higher pressures. Even more progress will be made toward eliminating square boxes and corners, drums and tubes will have smaller diameter, and the boiler will assume more the appearance of a flash boiler. Steam pipes will require special precautions to care for expansion and contraction. Greater care will be needed as to the quality of the boiler feed-water. The more pure the water the greater its affinity for air, CO_2, and oxygen, hence these must be kept down to a minimum by not exposing the condensate to the air between condenser and boiler. The location of feed-water pumps so as to be merely an extension of the condenser shell would be an advantage and may, perhaps, become a necessity. And because a temperature of not less than 212 deg. F. is required to appreciably reduce the quantity of air in water, atmospheric-pressure feed-water heaters may become part and parcel of the equipment made necessary for higher steam pressures and superheat. These are just a few of the more apparent changes one may expect to come with radical increase in steam temperatures.

The greater the heat drop the greater thermal efficiency of a turbine. With the one extreme fixed and now almost practically reached, namely, the vacuum, which can now be maintained 97 per cent perfect, there is no alternative except to extend the other extreme, namely, the temperature, by increasing pressure and superheat. The benefits of doing this are so great and the need for doing so is so urgent on the score of fuel conservation, that it is sincerely hoped progress may be made steadily, safely and rapidly.

The Economizer in Turbine Power Plants

THE economizer is beginning to find the favor in this country that it long since found in European power plants. And central-station power plant practice is favoring, if not compelling, its utilization.

With the tendency toward higher steam pressures, some radically higher are already in use, comes higher stack temperature, resulting in increased loss of heat up the stack, a loss more than compensated for, however, by improvements in turbine efficiency. By installing economizer heating surface in the path of the

flue gases, much of the heat that would otherwise pass up the stack unused can be turned to usefulness. The economizer thus becomes a natural addition to high-pressure steam plants.

Another factor has contributed to the comparatively rapid adoption of the economizer in this country. That is, the sure and steady tendency to operate boilers at what is customarily called forced rating but what is, in fact, operating at higher rates of evaporation than the 34.5 lbs. of water per hour per sq. ft. upon which the boiler horsepower rating is based. Operation at higher rates of evaporation means the gases of combustion pass through the flue-gas passages at a more rapid rate, leaving the heating surfaces for the stack also at higher temperature. Economizer heating surface is able to absorb much of the heat contained in these gases, how much depending largely upon the amount of economizer heating surface installed. Motor-driven auxiliaries, instead of steam, also exerted an influence.

With both the above conditions existing, namely, flue gases of higher temperature due higher temperature of boiler contents, and higher stack temperatures because of more rapid travel of gases through the boiler passes, conditions existing in most large central stations, and most of the latest constructed, the economizer naturally becomes a necessary adjunct to the plant operating at high rates of evaporation and high pressure steam. In fact, it is to the credit of the economizer that many of the high efficiencies, low turbine water rates, are being obtained today.

Just as higher steam pressures have encouraged the economizer, so also have they influenced economizer design. The economizer, though a feed-water heater, is subjected to conditions more nearly approaching those of a boiler. Cast-iron tubes are being replaced by tubes of wrought iron and steel, because of the necessity of withstanding higher internal pressures. Steel is more readily corroded than cast iron, a reason responsible for retarding the use of steel tubes, as well as that of cost. The adoption of higher steam pressures, therefore, directs special attention to preventing corrosion of tubes of steel. The tubes must be kept free of soot, clinker and flue-gas dust, corrosive in themselves and particularly prone to be so in the presence of moisture. If gases are cooled below the dew-point, and with the gases high in sulphur, which is particularly the case with many of the lower grades of coal, rapid corrosion is to be expected.

Steel tubes protected by galvanizing are finding favor for withstanding corrosion. A further safeguard to be looked for is the use of soot blowers in in place of the customary scrapers, a practice which would be accompanied by other advantages. Air infiltration tends to become obnoxious at high ratings where large economizer surface is employed or when passages are choked, because of the greater draft intensities necessary to pass the requisite amount of gas through the passages, a condition affecting both boiler and economizer efficiency. This influx of cold air has been reduced in some cases by using soot blowers instead of the scrapers, thereby eliminating the openings required for the mechanisms operating the latter, permitting a reduction of openings, and simplifying the use of steel-encased settings. The synchronism of the forced and induced-draft blowers for harmonious operation together, so as to maintain balanced draft conditions between furnace and economizer, to prevent the building up of pressure or formation of vacuum in the passages between furnace and economizer outlet also has enabled air infiltration, explosions in the breechings and similar troubles to be prevented and overcome.

Apart from raising the efficiency of a station, a number of other advantages accrue from the use of the economizer. The boiler is subjected to less severe treatment because the feed-water is of more uniform temperature, hence there is less expansion and contraction—an advantage even if of theoretical rather than practical importance; additional capacity is obtained by its use because of the heat-storage capacity of the economizer; and then the economizer acts as a water purifier, another condition forcing itself to the fore with the coming into vogue of high rates of evaporation and higher temperatures.

The economizer is one of the links in the long chain of power plant functioning, whatever the fuel used, that deserves more consideration and attention than it usually receives. Economizer heating surface is of lower cost than boiler heating surface, and needs less attention than the latter. Less spectacular than the boiler, out of sight out of mind, the economizer is a very important piece of apparatus that is now beginning to come into its own.

Government Has Not Ordered Curtailment of Advertising

THE rumor still persists that the Government has ordered a severe curtailment of advertising in periodicals, which is given as an excuse for withholding advertising from some papers.

This is not true. Probably the best "comeback" to such advertisers will be to quote the recent statement of Hon. W. B. Colver, chairman of the Federal Trade Commission, on this subject.

In part Mr. Colver said:

"Discontinuance or even sharp curtailment of advertising, because of temporary war conditions, would seem to imperil the most valuable asset that any business has—namely, its good will. No more faulty logic can be found than that which would impel a manufacturer to cease building for the future by means of advertising, simply because the output of his factory is, for the time being, restricted; or because diversion of his facilities to war work has operated to withhold his goods from accustomed markets. In modern business there can be no 'sufficient unto the day' policy.

"In advertising the business man has built up the intangible or spiritual side of his business, if such it

may be designated, as distinct from the material side. It is the spiritual side as represented by the good-will, that is slower of growth and that is the more seriously jeopardized by neglect—neglect which could take no more disastrous form than an interruption to advertising.

"Good-will in my estimation is far more valuable than the physical property with which it is linked.

"The manufacturer who has converted his factory to war work and has therefore interrupted the production of his original line, does not tear down and discard his expensive machinery to save the insurance premiums or other similar expenses. It would be just as sensible for a manufacturer whose commercial integrity is founded upon advertising to abandon his advertising campaign in order to save the carrying charge upon his greatest asset, good-will.

"They told me when I was a youngster that even the Lord can't make a 2-year-old calf in a minute. Big advertising spreads after the war will meet equally big spreads. Business will bid for public attention and interest on a bull market. The purpose will be to put a punch in good-will which has gone flabby. The man who goes into that contest with a public attention and interest which he has never allowed to relax will go in with his good-will trained to the minute.

"He will win."

Mr. Colver's entire statement follows the same general tenor. Instead of the Government calling for a reduction of advertising, here we have the chairman of the Federal Trade Commission urging a continuance of advertising.

Co-operative Meter Reading and Billing

ECONOMY in every branch of utility service was never as imperative as now if the higher costs of fuel, labor and other utility needs are not to necessitate a corresponding increase in rates for all classes of service. Rates for several classes of electric central-station service have been raised in many communities, these increases applying chiefly to power supply. Special effort has been made in most cities, however, to spare residential customers from rate advances except as a last resort. Such customers pay the highest rates for electric service because it costs most to render this service. This high cost is due partly to the greater investment required for distributing lines and service connections per unit of energy sold, but chiefly to the comparatively high cost of reading meters, preparing and distributing bills, making collections and other features connected with keeping track of each customer's account.

It has been felt for a long time, even before we entered the war, that here is a fertile field for the development of economy. Various measures have been suggested for promoting this, among which was reading of meters and billing bimonthly instead of monthly, thus cutting this expense in half. In the case of combination gas and electric companies it had been customary for some time to have the same inspector read both meters and the accounting department prepare a single bill for both gas and electricity. The evident economy of this scheme led to a suggestion that it be entered into even where these two services were rendered by competing companies; this matter was discussed in a question and answer published in this journal several years ago, it having been noted that the inspectors of both companies called to read meters on the same day in many instances.

Replacing competition by co-operation was hardly thought possible until progress of the war brought labor shortage and urgent need for the elimination of all duplication of effort and other unnecessary work. To avoid the wastes of excessive competition we are now witnessing many instances of rival companies pulling together for the common good, a phenomenon that would have been regarded formerly as unusual as to see a dog and a cat playing peacefully together. Co-operation is now being recognized not only as a constructive but economical agency and a splendid example of this is the definite suggestion for co-operative meter reading and billing made by E. W. Hammond of the Kansas City Gas Company. As stated in our last issue, he has suggested a single bureau for reading the meters of all the utility interests, rendering joint itemized bills and making all collections. Thus in Kansas City he would have one organization acting for the four utilities—water, gas, electricity and telephone—that now independently send meter readers and collectors to practically the same customers throughout the city. This is an extension of the scheme mentioned above so as to apply not only to the two similar and competitive services of gas and electricity, but also to the other less closely related services whose practices are not similar, except that they involve periodic calls on nearly the same customers.

Mr. Hammond's suggestion is worthy of the most careful consideration in all large cities. It provides for an economical solution of the most costly feature of residence service by the utilities, while at the same time reducing the inconvenience to the householder of having three or four representatives of the utilities make personal calls each month; furthermore, it simplifies the payment of bills at a single central office or district offices of this central organization. In the matter of joint meter reading and delivering of bills alone there would be a very substantial saving over the present wasteful practice that doubtless would make residence service less expensive and might on the return of normal times permit reduction of residence rates. Several apparent difficulties in adjusting the date of monthly meter reading, date of bill and discount period, etc., would have to be overcome, but these are relatively minor objections that no doubt can be overcome. The plan is much more practical and less objectionable than the proposed employment of women for meter reading, which has been prohibited in some places.

Week's Events

Jovians to Meet at Dallas—Northwest Association Holds Meeting—Vacuum Cleaner Lines Reduced to Two Sizes

JOVIAN CONVENTION TO BE HELD AT DALLAS IN OCTOBER.

New Plan of Financing and Participation in War Activities to Be Principal Matters Discussed.

There are two important questions that stand out prominently before the Jovian convention to be held October 24-26, at Dallas, Texas. They are: First, that of financing the organization, and, second, that of directing the greater part of the activities of the organization during the coming year to war work.

Concerning the first question, it is but necessary to state that the drain of war conditions, through enlistments and other war activities of the membership have been so heavy that a new scheme for financing has become necessary. According to a statement of some of the officers of the Order, a plan that appears to be more feasible than any heretofore considered has been decided upon. This plan, according to those who have had it under consideration, if adopted, will to a great extent remove the burden of financing the Order from the rank and file of the membership, by a reduction of the annual dues, while at the same time providing a source of revenue that will fully offset the depletion of income by the call of members for war service.

While particulars of the plan cannot be given out at this time, it may be stated that all officers and members who have been instrumental in constructing it and other members who have been consulted are strong in the belief that it offers the solution for financing the organization that has been sought for the past several years.

The other question, that of directing the activities of the Order to war work, presents the paramount constructive feature to be considered. Plans have been formulated for the purpose by the executives of the Order but definite decision concerning their adoption will rest with the delegates to the convention. In fact, there are several plans under advisement, the prime object of all of them being to turn the forces of the organization to Government uses to be utilized in whatever manner may be deemed the most effectual.

The selection of the one that is the most feasible will, it is felt, require considerable discussion and will command the attention of the delegates during at least one entire session of the convention.

One feature that permeates all of the plans so far considered is the thought of directing the whole organization towards some specific phase of war work of a national nature, and that this work be one of an electrical nature, one that at least the major part of the industry can co-operate in promoting effectively.

The following members compose the Attendance and Entertainment Committee: A. Hardgrave, chairman, H. E. Hobson, A. I. Folsom, S. G. Vigo, and Dan G. Fisher.

The committee gives assurance of a splendid welcome from the various organizations of the city of Dallas, and that preparation will be made to accommodate the usual attendance of delegates and visitors. Although, owing to war work, a great many members will have to make something more than the usual sacrifice to attend, it is felt that the importance of the questions under consideration will outweigh personal affairs and the convention will draw a good attendance.

MAKERS OF VACUUM CLEANERS AGREE TO LIMIT SIZES TO TWO.

Also Will Discontinue Manufacture of Less Essential Attachments.

Representatives of manufacturers of power-driven portable vacuum cleaners have agreed with the Conservation Division of the War Industries Board, in the interest of economy and conservation, to reduce their lines to not more than two models or sizes of such vacuum cleaners, to discontinue the manufacture of less essential attachments, and to discontinue the use of metals where such use is not absolutely essential.

Under the heading of "attachments" which are to be discontinued are included extra tools for cleaning other than floors or floor coverings, such as those for cleaning curtains, tapestries, wall coverings, furniture, and other articles, and the extra suction hose which is cataloged generally with such attachments.

The manufacturers are to discontinue at once the addition of new models or sizes of portable machines and the use of any sort of metal for purely ornamental or other unnecessary purposes. These plans will result in an annual saving of at least 100 tons of steel, 5 tons of brass, 125 tons of aluminum, and 1,000,000 feet of rubber hose.

The Conservation Division has sent out the following letter:

In the present emergency it is of primary importance that the country's resources be used to full advantage and that we husband our supplies of materials, equipment, and capital to aid in carrying on the war. This division is endeavoring, in co-operation with numerous industries, to determine upon plans of economy in order that materials and equipment may be saved and the amount of capital invested in manufacturers' and dealers' stocks reduced.

It is believed that manufacturers of vacuum cleaners can reduce their lines to not more than two models or sizes and that the manufacture of the less essential "attachments" which have been sold heretofore in connection with these machines can be discontinued as a measure of conservation. Every manufacturer should, furthermore, discontinue the use of metal of any sort for any purpose where its use is not absolutely essential. By these means it is believed that materials can be saved and the amount of capital invested in manufacturers' and merchants' stocks reduced.

The program has been drawn up with the assistance and advice of representatives of the industry.

NORTHWEST ASSOCIATION HOLDS IMPORTANT ONE-DAY SESSION AT PORTLAND.

President Talbot Urges Effort to Inform Public— Report of Public Policy Committee—Ringing Resolutions of Loyalty.

The eleventh annual convention of the Northwest Electric Light and Power Association, held in Portland, Ore., September 13, was confined to a one-day session, and was attended by about 50 representatives of light and power companies of Oregon, Washington, Idaho and Montana.

The convention was opened by Guy W. Talbot, president of Pacific Power & Light Company, Portland, president of the association. Mr. Talbut, in his presidential address, reviewed the rapidly changing conditions during the last four years which have increased operating and maintenance costs to such an extent as to make existing revenues inadequate to meet the demands for enlarged services. A few of the salient sentences from his address are as follows:

"Public service commissions aim to be fair and just, but are disposed to be led by and not to lead public opinion. Delay in giving relief has served to place public utilities generally in a most precarious financial condition.

"The ills of increased costs certainly were apparent to the commissioners and the remedy of rate advances equally obvious, but public opinion was largely uninformed as to the facts and needed to be led by action of the commissions.

"One of the practical means for the public utilities to get adequate relief is to help themselves through co-operative action. It is my recommendation, therefore, that the effort of the association for the forthcoming year and as long thereafter as the necessity exists, be devoted to the question of ways and means to inform the public and to obtain the necessary relief to keep the industry in a state of efficiency, in order that it may be in a position to respond effectively to the necessities of war production, direct and indirect, and meet its obligations to the investing public."

The water-power measures pending in Congress were referred to by Mr. Talbot, who expressed the hope that the final result would be the enactment of a law that would secure Government co-operation in the development of power on the public domain.

A report by Geo. L. Myers, secretary and treasurer of the association, showed an excellent financial condition, and gave some facts as to the association's membership. On motion, it was decided that Class B members in military and naval service be continued on the membership roll without the payment of dues, during their terms of such service.

Reports of Committees.

In the afternoon the convention was presided over by O. B. Coldwell, general superintendent of the Portland Railway, Light & Power Company, chairman of the executive committee. This part of the session was devoted mainly to hearing the reports of the Hydroelectric and Technical Committee, Public Policy Committee, Labor Study Committee, Range Committee and Executive Committee.

H. L. Walther, manager of California-Oregon Power Company, Medford, Ore., as chairman of Public Policy Committee, discussed the attitude of the public utilities with reference to legislative action, and submitted the following, which was adopted:

"Whereas, it has been demonstrated in the state of Washington that it is important, under present operating costs, to conduct street railway transportation with a maximum fare limited to five cents; and

"Whereas, the Public Service Commission of the state of Washington has, in several instances, found that five cents is an inadequate fare for street railway transportation, but has failed to grant proper and necessary relief because of limitations in the act creating the Public Service Commission of Washington, providing that the Commission's jurisdiction shall not extend to increase fares above five cents;

"Now, therefore, be it resolved, that we urge the members of this Association to exercise all proper endeavors to eliminate from the Public Service Commission of the State of Washington the limitation upon the power of the Commission to properly discharge its duties as a regulating body and to provide fares adequate to meet the conditions of street railway operation.

"Resolved, that in applications for rate increases, due to increased cost of materials and operations, we are opposed to the system of adding surcharges to existing rates as inconsistent with the theory of regulation; and be it

"Further resolved, that we advocate the establishment of rates by regulating bodies based upon existing conditions, reserving unto the regulating bodies, as now by law provided, full power to change or alter such increased rates at any time conditions may justify."

With respect to national legislation, the following resolution was adopted:

"Be it resolved by the Northwest Electric Association now in session, that a committee of two be appointed by the incoming presiding officers to address Honorable William G. McAdoo, Secretary of the Treasury of the United States, to respectively ask the legislators of the Northwestern States to refrain from introducing and passing any legislation detrimental to the public utility companies of these states."

H. H. Schoolfield, chief engineer of Pacific Power & Light Company, Portland, gave a verbal report on behalf of the Hydroelectric and Technical Committee. He discussed the National Safety Code prepared by the Bureau of Standards, and outlined the progress of conferences relative to its adoption and as to how its adoption would affect the public utility companies.

F. H. Murphy, chairman of the Committee on the Co-operation of Electrical Contractors, Jobbers and Central Stations, made a brief verbal report, referring especially to the ideas of the Goodwin Plan. He showed the need of unity of action and mutual confidence, the declaration of a purpose and the adoption of a code of ethics.

John Harisberger, general superintendent of light and power for Puget Sound Traction, Light & Power Company, Seattle, reported for the Committee on Labor Study. This report, which covered a considerable range of study, was based on facts gathered as the result of a questionnaire sent out to all members of the association some time ago.

Patriotic Support of War Measures Re-Affirmed.

The convention unanimously adopted the following staunch resolution, pledging unlimited and loyal support of the Government in the prosecution of the war against Germany:

Resolved, that we, the officers and members of the Northwest Electric Light and Power Association, in annual meeting assembled, do hereby confirm and re-

new the assurances to the President and all others in authority, of our support and co-operation in maintaining and carrying on the war, as set forth in the resolution adopted by our representatives at the annual convention of the National Electric Light Association at Atlantic City on June 13, 1918. At this moment, as the heroic, war-tried armies of our Allies and the new and mighty American army have so successfully begun the final march to victory, and as this nation has completed the enrollment of additional millions of its sons to assure the speedy, unlimited exercise of the nation's power in the supreme effort before us, we again solemnly pledge every effort and every resource of ourselves and our industry, unqualifiedly and unreservedly, to the support of the President and of the nation to the prosecution of the war to a victorious and complete realization of the noble aims for which we have taken up arms. Come whatever burden or whatever sacrifice, no hand will falter or no spirit fail until these objects shall have been definitely and permanently accomplished.

The convention, on receiving information of the death of Frank A. Harmon, superintendent of Eastern Oregon Power Company, Baker, Ore., adopted a resolution, setting forth the high esteem in which the deceased was held.

Election of officers resulted as follows: President, L. B. Faulkner, Olympia, Wash.; vice-presidents: H. L. Walther, Medford, Ore.; H. L. Bleecker, Spokane; W. T. Wallace, Boise; J. F. Roche, Butte.

Papers submitted and printed as a part of the proceedings, but not read at the convention, were: "Diversifying Customers' Loads," by J. R. King; "Purchasing Problems," by V. G. Shinkle; "New Business During War," by R. M. Boyken.

One of the interesting features of the convention was a one-minute speech by everyone present. This helped along the get-together spirit and brought out many expressions that reflected everyday problems and how they were being met.

Members in Attendance.

C. M. Shinn, Cottage Grove (Ore.) Electric Company; George D. Brown, president and general manager, Wenatchee Valley Gas & Electric Company, Wenatchee, Wash.; L. V. Harper, manager Chelan Electric Company, Chelan, Wash.; John Harisberger, general superintendent of power and light for Puget Sound Traction, Light & Power Company, Seattle; O. G. F. Markhus, general superintendent Idaho Power Company, Boise, Idaho; Guy W. Talbot, president Pacific Power & Light Company; Lewis A. McArthur, general manager, C. R. Young, sales manager, and George L. Myers, assistant to the president, of Pacific Power & Light Company, Portland; O. B. Frank, manager Douglas Light & Power Company, Roseburg, Ore.; Northwestern Electric Company, Portland, represented by George L. Bowen, sales manager, A. L. Leach, A. Hudworth, L. T. Merwin, general superintendent; Portland Railway, Light & Power Company, represented by Franklin T. Griffith, president, O. B. Coldwell, general superintendent, R. M. Townsend, A. C. McMicken, sales manager, F. H. Murphy, H. C. Schade; P. A. Bertrand, Grays Harbor Railway & Light Company, Aberdeen, Wash.; J. T. Thompson, manager, Sheridan (Ore.) Light & Power Company; Elmer Dover of Mountain States Power Company, a Byllesby organization, Tacoma, Wash.; W. R. Echternach, of Lewiston (Ida.) Power Company; E. G. Robinson, Molalla Electric Company, Molalla, Ore.; C. J. Edwards, Coast Power Company, Tillamook, Ore.; H. L. Bleecker, vice-president Washington Water Power Company, Spokane; H. V. Gates, Hillsboro (Ore.) Power & Investment Company; C. E. Taylor, Stayton, Ore.; R. M. Boyken, general manager North Coast Power Company, Portland; R. J. Moore, Yamhill Electric Company, Newberg, Ore.; R. M. Steelquist, Oregon Power Company, Albany, Ore.; W. A. Scott, Electrical Review, Portland; Robert Sibley, *Journal of Electricity*, San Francisco; F. D. Weber, Oregon Insurance Rating Bureau, Portland.

IRON AND STEEL ELECTRICAL ENGINEERS MEET.

Papers and Discussions Consider Conservation of Man Power in Steel Industry—Election of Officers.

Many papers of war-time interest were presented at the three-day convention of the Association of Iron and Steel Electrical Engineers that was held at Baltimore, Md., September 11 to 14. Considerable attention was given the conservation of man power and also to the education for electrical employees who must be secured and who usually have had but limited experience.

In a paper presented by the Educational Committee, on the first day, it was urged that the education of employees be made a permanent policy, not simply a war measure, since the capital and effort expended would be repaid many times and would also tend to decrease the tendency for an employee to change positions.

The paper offers numerous concrete suggestions for inaugurating educational work and presents six methods of instruction, as follows: (1) Laboratory Method, (2) Study and Recitation Method, (3) Lecture Method, (4) Inspection Trip Method, (5) Conference Method, (6) Local Instruction School Method.

The convention, which was the twelfth annual meeting of the association, was opened on Wednesday morning, September 11, with a brief business session. Following this the reports of the committees on electric furnaces, safety, standardization and membership, were presented.

At the afternoon session the Safety Committee of the association presented its report on "Rules for Safe Operation of Electric Cranes." This report embodies 22 definite rules to be observed in the operation of cranes and a supplementary set of 11 rules to be observed by operators, and which it is suggested be printed and placed in crane cabs.

The last feature of the afternoon session was a paper by Walter Greenwood entitled, "Automatic Engine Stops." The conclusions of the author can be summarized as follows: Automatic engine stops are indispensable adjuncts to all kinds of engines that can overspeed and cause a wreck or accident. They are dependable when carefully installed and carefully maintained. Their use probably can be extended to include blast engines, and to the performance of various other offices where they would prevent wrecks. Of several types of installation, any can be relied on to act when required if they are properly constructed and reasonable effort is made to maintain them. When it is considered there are instances where the most primitive make of stops, with some change of construction from time to time as suggested by experience, have been kept constantly in dependable condition as proven by frequent tests, and by responding to demands on them by reason of failure of controller or engine parts, there can be no argument to offer against any of the most

modern designs. As the makers are not confined entirely to particular designs that will not fit all conditions, a combination of principles can be made by any of them that will suit any reasonable requirements. In making an installation, consideration should be given to those features that manifestly are the most dependable and will require the least expenditure of care. This in no manner absolves from constant watchfulness and necessary care.

Thursday morning there was a paper by R. H. McLain, entitled, "Bridge Motors for Overheal Traveling Cranes," and a paper entitled, "Condensers and Condenser-Engineering Practice," by D. D. Pendleton. Mr. McLain's paper sets forth numerous rules to be observed in selecting the proper size of motor and gear ratio for bridge motion of overhead traveling cranes.

At the afternoon session two papers were presented as follows: "Standardization of Ratings of Large Rolling-Mill Motors," by K. A. Pauly, and "Electrically Driven Mills," by J. T. Sturtevant.

A patriotic meeting and banquet was held on Thursday evening at which addresses were made by General Black, chief of engineers, United States Army; General Gaston, commander of Camp Meade, Md., and Dr. McDowell of the Y. M. C. A.

One paper was presented on Friday morning as follows: "Remote-Controlled Substation," by W. T. Snyder; also the report of the Standardization Committee for 1918. The paper by Mr. Snyder was published in our issue of September 14.

Friday afternoon was given over to an inspection trip through the shipyards and steel mills of the Bethlehem Steel Company at Sparrows Point, Md.

The officers elected for the ensuing year are:

President, D. M. Petty, Bethlehem Steel Company, Bethlehem, Pa.

First vice-president, B. W. Gilson, Carnegie Steel Company, Youngstown, O.

Second vice-president, H. C. Cronk, McKinney Steel Company, Cleveland, O.

Treasurer, James Farrington, La Belle Iron Works, Steubenville, O.

Secretary, J. F. Kelly, Pittsburgh, Pa.

Directors: E. S. Jeffries, Steel Company of Canada, Hamilton, Can.; G. W. Richardson, American Bridge Company, Pencoyd, Pa.; F. A. Wiley, Wisconsin Steel Company, Chicago, Ill.; Walter Kennedy, Pittsburgh Crucible Company, Midland, Pa.

ELECTRICAL EXPORTS FOR JUNE AND FISCAL YEAR.

June Figures Well Over Average—Fiscal Year Ended June Exceeded Only by Calendar Year 1917.

Through the publication of the monthly summary of the foreign commerce of the United States for last June, which has just been published by the Bureau of Foreign and Domestic Commerce, Washington, D. C., there are made available export data not only for that month but also for the fiscal year ended June 30 last. These statistics show that as regards electrical exports the June totals were slightly above the average of the last 12 months, though a little over 10 per cent below the record total of June, 1917. The data on the last fiscal year show that the electrical total exceeded all previous corresponding fiscal years by over $2,620,000, but was about $950,000 less than the high total of the calendar year 1917.

In the following table are given the detailed electrical figures for last June and the figures for the corresponding month of last year; also comparative figures for the last fiscal year ended June 30, 1918, and the fiscal year ended June 30, 1917.

Articles.	June 1918.	June 1917.	Fiscal year ended June 30. 1918.	Fiscal year ended June 30. 1917.
Batteries	$ 272,316	$ 442,846	$ 3,351,838	$ 3,009,676
Carbons*	117,995	.....	1,525,128	.....
Dynamos or generators	133,549	277,575	2,688,169	2,554,504
Fans	164,486	79,580	818,338	482,652
Heating and cooking appliances*	49,185	.....	533,988	.....
Insulated wire and cables	340,138	633,235	5,716,275	7,192,204
Interior wiring supplies, including fixtures	138,805	102,731	1,532,309	1,123,664
Lamps—				
Arc	90	1,061	13,308	15,752
Carbon filament.	3,985	20,949	144,761	157,413
Metal filament	475,768	357,275	3,183,021	2,143,502
Magnetos, spark plugs, etc.*	167,710	.....	3,167,325	.....
Meters and measuring instruments	208,294	84,072	1,592,195	1,039,149
Motors	521,442	643,862	6,598,664	5,889,770
Rheostats and controllers*	24,170	.....	212,059	.....
Switches and accessories*	188,408	.....	2,229,023	.....
Telegraph apparatus, including wireless	11,659	19,915	294,297	539,389
Telephones	274,809	283,152	2,566,929	1,953,504
Transformers	464,195	162,180	2,235,847	1,265,459
All other	1,462,515	2,472,009	16,123,996	24,536,385
Total	$5,019,519	$5,580,442	$54,527,570	$51,903,823

*Not separately listed prior to July 1, 1917.

The following table gives the electrical export totals for the 12 months of the last fiscal year, thus showing the fluctuations from month to month.

Months of fiscal year.	Electrical exports.
July, 1917	$3,827,345
August, 1917	3,607,278
September, 1917	4,190,116
October, 1917	4,151,635
November, 1917	5,374,117
December, 1917	5,726,376
January, 1918	4,656,611
February, 1918	3,446,801
March, 1918	5,147,921
April, 1918	4,572,953
May, 1918	5,013,379
June, 1918	5,019,519

The following table gives the electrical totals for the last six fiscal years, thus covering the period during and before the world war.

Fiscal year.	Electrical exports.
1917-18	$54,527,570
1916-17	51,903,823
1915-16	30,256,778
1914-15	19,771,757
1913-14	25,060,844
1912-13	26,772,816

GOVERNMENT CLASSIFICATION FOR ENGINEERS.

United States Employment Service Prepares Classification Blank for Engineers Seeking Positions.

Mention has been made in the ELECTRICAL REVIEW on several occasions of the work of the Division of Engineering of the United States Employment Service, which is receiving applications from engineers seeking employment in various technical capacities in military, governmental and industrial establishments. The Division of Engineering has central headquarters at 29 South LaSalle street, Chicago, and in the short time that the work has been under way has received many requests for engineers who have been placed promptly with mutual benefit to the nation, the individual and the particular establishment seeking the engineer. To facilitate the work A. H. Krom, director of engineering, has prepared a classification blank to standardize and simplify the classification of applicants. This is reproduced herewith. It will be ob-

served that it is very easily filled out and shows in very compact form what is substantially the history of the applicant's experience in different branches of engineering work. A further sub-classification is made in the middle portion of the card.

In making application for a position a copy of the card can be obtained from the address given above, or this very sheet can be used. Preference is given to men not now engaged in war work and to men who can leave their present abode because many of the positions open are in cities distant from the probable place of residence of the applicant. This classification conforms in general to that made within the last year or eighteen months by several of the engineering societies, but presents the information in a more condensed form so as to facilitate classification in accordance with experience, location and other features.

Among representative positions now open are the following: Four electrical engineers for work in Ohio; two chemical engineers in Iowa, and two chemical engineers on zinc manufacture in Illinois; several teachers of radiotelegraphy; five mechanical engineers, assistant to the engineer in charge of levee building in Louisiana; 29 draftsmen for railroad work in Illinois; several draftsmen for hull, rigging and cargo-boat design in shipyards; several naval architects and marine engineers for shipyard service; transit men, rodmen, structural and mechanical draftsmen for the civilian personnel of the War Department. The Division of Engineering gives its services free of charge to all employers seeking engineers, as well as to engineers and other technical men who register with it. In quite a few lines of engineering business activities are considerably below normal so that many men can no doubt be spared for the more essential war and industrial needs of the country.

GOVERNMENT CLASSIFICATION BLANK FOR ENGINEERS.

EXPERIENCE									ENGINEERING						SALARY	
Place number of years' practice in proper spaces below.									Indicate by X your special classification						Give figures on monthly basis	
Consulting	Commercial	Designing, Detailing and Checking	Contracting	Construction—Supt or Foreman	Inspection, Testing and Analyzing	Operation, Valuation & Scientific Management	Surveying—Instrument Man	Drafting—Tracing	CIVIL	MECHANICAL	ELECTRICAL	MINING	CHEMICAL	Architects, Salesmen and Teachers, give specials below	Salary Desired	Lowest Considered

CHECK YOUR EXPERIENCE ON SUB-CLASSIFICATIONS

I CIVIL ENGINEERING
1—Bridges
2—Buildings
3—Reinforced Concrete
4—Highways
5—Railways
6—Harbor Work
7—Dams and Reservoirs
8—Reclamation
9—Waterways
10—Municipal
11—Water Supply
12—Sanitation
13—Ship Building
14—Structural Steel

II MECHANICAL ENGINEERING
1—Ordnance
2—Bridge Machinery
3—Dredging Machinery
4—Hoisting & Conv. Mchy
5—Machine Shop Mchy
6—Refrigerating Mchy
7—Steel Mill Machinery
8—Textile Machinery
9—Light Automatic Mchy
10—Marine Engines
11—Automotive
12—Internal Comb. Engines
13—Aeronautics
14—Gas Mfng Equipment
15—Steam Plant Equipment
16—Heat., Vent. & Bldg. Eqpt.
17—Industrial Plants
18—Railway Rolling Stock
19—Tools

III ELECTRICAL ENGINEERING
1—Batteries, Ignition
2—Electric Railways
3—Industrial Elec. Appl.
4—Switchboards
5—Light and Power Plants
6—Control Equipment
7—Motors and Generators
8—Transformers
9—Overhead Construction
10—Radio and Wireless
11—Railway Signaling
12—Telephone
13—Telegraph
14—Testing Apparatus

IV MINING ENGINEERING
1—Assayer
2—Drilling Machinery
3—Metallurgist
4—Mill and Ore Dress Mchy
5—Mineralogist and Geolo.
6—Mine Survey
7—Mining Machinery
8—Coal
9—Open Pit
10—Ore Dressing Mills
11—Petroleum
12—Smelter and Equipment
13—Underground Mining

V CHEMICAL ENGINEERING
1—Chemical Plant Equipt.
2—Cement
3—Due Stuff
4—Explosives
5—Fertilizer
6—Gas
7—Oils
8—Glass
9—Soap
10—Hide and Leather
11—Iron and Steel
12—Paint
13—Photographic Supplies
14—Water Purification
15—Sewerage Treatment
16—Wood By-Products and Preservatives

Specials_____

I { am / am not } engaged in war work and { will / will not } leave present location.

My age is_____ and my draft classification is_____

Print name_____

Print address_____

PLEASE FILL OUT AND MAIL AT ONCE TO DIRECTOR OF ENGINEERING

Commercial

Diversifying Loads to Meet Increased Demands—Successful Operation of Electric Pumps in Diking Districts

DIVERSIFYING CUSTOMERS' LOADS.

Artificial Diversification Necessary So That Increased Demands Can Be Handled.

The war in which this country is now engaged has forced economies of various kinds on nearly every industry, not excepting the central station. Not the least of these is power economy—that is, making one kilowatt do the work of two, or even three. When a central-station plant is confronted on the one hand with a large increase in its load, and on the other hand with inability to obtain additional generating equipment, it must, perforce, make a careful survey of its field, to see where economies in the use of power can be effected, in order that it may render satisfactory service to essential industries, and do its part in winning the war.

One of the conceptions developed by this situation is that of diversifying the load on its system so that it may handle the increased demands with the means at its disposal.

Except in isolated cases, there has been heretofore very little, if any, effort to control a customer's use of the power furnished to him, the argument being that after the current passed through the meter, the central station had but nominal control over it, and this control was seldom exercised, except in the event of improper use. The propositions advanced in this discussion are predicated on the theory that the central station has, as a war measure, absolute authority, either of itself, or delegated to it by governmental agencies, to control without question the consumer's use of the power supplied to him, with the ruling motive of best accommodating essential industries.

In a paper before the recent convention of the Northwest Electric Light and Power Association, J. R. King presented a concrete plan for making such a power survey. The first step is to study local conditions, and to decide at what point the plan shall begin, or rather what size of load shall be considered. Ordinarily it is best at this stage to consider the connected load, as that is more of a definite quantity than the demand. Assuming that connected loads of less than a certain amount do not affect the system to an extent to warrant taking them into consideration, the next move is to prepare a list of all consumers having connected loads in excess of that figure. This should be carefully checked and brought up to date, as many heretofore insignificant power users have increased their loads almost over night, due to enlarged demands for their products. Re-checks of customers' installations are in some cases necessary to establish in which class a customer belongs.

It is assumed that the central station keeps a file showing each customer's list of motors, the machines they drive, the latest data regarding the demand, the product manufactured and the amount produced per day or per month, the hours of plant operation, and other information that may be of interest. With any large number of users it is rather laborious to prepare a file of this sort, but after it is once established and kept reasonably up to date, it will be found that the trouble has been well worth while.

With regard to the determination of customers' demands: Timing of meters with a stopwatch at intervals during the working day is the quickest method. This method is not the most accurate, and if time, instruments and men are available, the installation of a curve-drawing meter for a few days or longer will be found to be of advantage, as it will also check the customer's statement regarding his hours of operation.

The information regarding transformers and meters is of rather special interest, inasmuch as the salesman usually gets information ahead of the operating department of proposed increases in connected loads as well as increases in demands, and by reference to the power survey, is in a position to advise whether larger transformers and meters will be needed, or whether the present installation will do, and thereby assists not only in saving unnecessary labor, but also in conserving transformer capacity.

Armed with information from this file, the territory salesman calls on the customer and lays the central station's case before him at the same time obtaining information regarding present and future load increases, changes in working hours, for what purposes the product is to be used (war materials, food or clothing supplies, non-essentials, etc.). The customer should be asked if he is working on government contracts directly, or if he is supplying other firms working on government work. He should then be asked what amount of electrical capacity he could release in the event of an emergency—that is to say, what machines could be shut down temporarily, and not impede the output of war essentials.

This conversation will call for a good deal of tact on the part of the central-station representative, and he should not fail to leave the customer with the facts firmly fixed in his mind that the information asked for is to be used only in case of an extreme emergency, and that all consumers in the same class will be treated alike. In other words, that no individual power user is to be selected as a special victim, and all the others allowed to "get by" without interruption. The company's resources and reserves should be explained, as well as other features promoting continuous service.

If the discussion has been properly handled, and the consumer made to feel that he is assisting in the carrying out of a war measure, it will be found in the majority of cases that the customers will gladly supply the desired data, and agree to co-operate to the best of their ability, if sufficient notice is given of any proposed power restriction, and very few of them will stand on technicalities. Occasionally a "hard customer" will be encountered, and in this event the best plan is not to excite him unduly, but to secure such information as may be obtained, and leave his case to be decided when the emergency arrives.

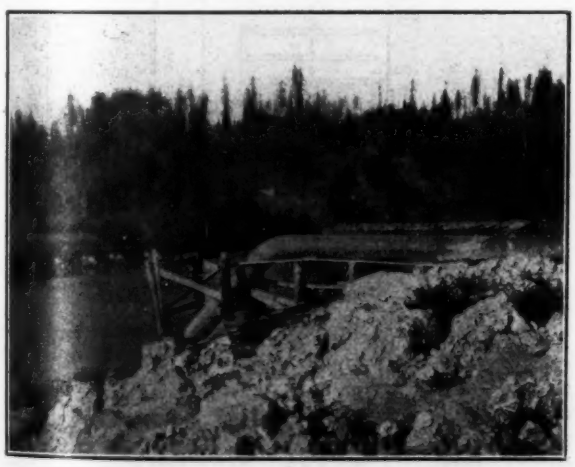
As the foregoing information is turned in by the salesmen it should be compiled in convenient form. The summation of these reports will show that quite a sizeable amount of capacity can be controlled simply by agreement with the user. This block of power can be considered as the central station's secondary reserve. All central stations have had in the past reserve capacity in the form of excess generating capacity at their main plants, or in plants intended for relay or standby service. The combination of machinery shortage and increased load, however, has in many instances moved these primary reserves up close to, if not actually into, the front line, and this controllable capacity in customers' installations can be considered as a secondary reserve, at the present time doing work behind the lines which is contributing to the well being of the community, but which can be called into action if needed for war purposes.

The customers as listed can now be grouped into classes, or assigned priority numbers, and this is a problem that requires very careful consideration and judgment.

ELECTRIC PUMPING IS CONSIDERED SUCCESSFUL IN DIKING DISTRICTS.

Five Low-Lift Pumping Plants in Use Reclaiming Overflow Land in Washington—Another Similar Project Planned.

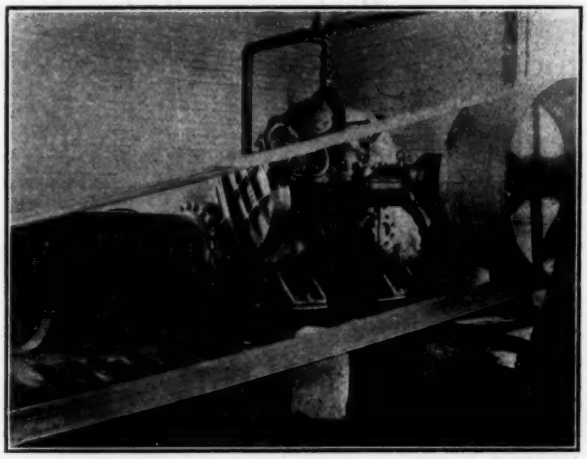
Electric pumping in the four diking districts of Cowlitz county, Washington, requires about 500 horsepower of energy during the season when land drainage is necessary. By a system of earthen dikes the flood waters from the Columbia and Cowlitz Rivers are held back and thus prevented from overflowing certain fertile tracts of land in the districts referred to. In the four districts, which are in the vicinity of Kelso, about 8800 acres of land have been reclaimed, first by building the dikes and then by operating pumps to relieve the land in the diked area of surplus water.



Forty-Foot Discharge from Electric Pump.

The four districts have five electrically operated centrifugal pumps, whose maximum lift over the dikes is 15 feet. The pumps, in some cases, are belted to the driving motors; in other cases they are direct-connected by flexible couplings. The motors used are alternating current, three-phase, 60 cycles, and operate at a pressure of 2300 volts.

The electric energy is transmitted at 45,000 volts to outdoor substations at the several pumping plants over the lines of the North Coast Power Company, where the current is stepped down to 2300 volts. One of the pumping installations, shown herewith, is typical of what is required for this work. It consists of a Platt Iron Works 24-inch centrifugal pump, of 19,500 gallons per minute, under a 5-foot head, belt-connected to a 75-horsepower motor. This is the pumping station of District No. 1, where there are two units of the capacity indicated. The volume of water required to



Centrifugal Pump Belted to 75-Horsepower Motor.

be pumped in any one season varies according to the rainfall in a given season and the stage of water in the Columbia River.

Three of the district projects are entirely completed and the land under them is producing mixed crops, unhindered by surplus water. The pumping operations have proved highly successful. The fourth district, while not completed as dike construction, has had its pumping plant in operation and a portion of the land is producing this year.

Another similar reclamation district has been organized to reclaim 11,000 acres of land on the Lewis River, near Woodland, Wash. This proposed project is within reach of the electric lines of North Coast Power Company, and when completed as planned it will require an additional load of 500 horsepower for electric pumping. This project involves an expenditure of $260,000, bonds for which have been voted.

SHAPING PUBLIC OPINION.

The correspondence between Secretary McAdoo and President Wilson apropos the statute of public utilities and the need for maintaining them in efficient condition if necessary by increased rates, has already been widely circulated from many sources. The Commonwealth Edison Company and Public Service Company of Northern Illinois have both circulated the letters amongst their customers. Envelopes sent out enclosing the monthly electric light and power bills have had printed upon them, "Copy of Letters from President Wilson and Secretary McAdoo enclosed with these bills." Each bill has contained in addition to the monthly statement, a neatly gotten up folder upon which is printed the letter from Secretary McAdoo to President Wilson, and the latter's reply.

The purpose of this is, of course, to familiarize the public with conditions in the utility field, the importance of the work the utilities are performing, and the attendant difficulties of the times, and thus prepare for higher rates, if the need arises.

Operating

Centrifugal Pump Motors—Gas Burners—Water Measuring —Reclaiming Boiler Tubes—Street Lighting Schedules

CHOICE OF DIRECT-CURRENT MOTOR FOR CENTRIFUGAL PUMPS.

Compound-Wound Instead of Shunt Motor Advocated for Safeguarding Motor.

By C. P. Royce.

Shunt-wound direct-current motors are often advocated for driving centrifugal pumps because of the low starting torque required by the latter presumably. The torque required by pumps of this class during starting is so low that the characteristics of the motor in this respect become of relatively slight importance. It has been found, however, that the speed regulation and other operating characteristics of the compound-wound motor more nearly counterbalance certain characteristics of centrifugal pumps and in general motors of this type are better suited for this class of service.

The average commercial compound-wound motor has about 20 per cent series winding, with a drop in speed from no load to full load ranging from 15 to 25 per cent. For centrifugal pump service a closer regulation is better. A 10 per cent series winding is recommended for use with centrifugal pumps.

One of the large electrical manufacturers now recommends, where direct-current motors are required, the compound-wound type for direct connection to centrifugal pumps and further refuses to accept any responsibility for motor operation when customers insist on shunt-wound machines for this purpose.

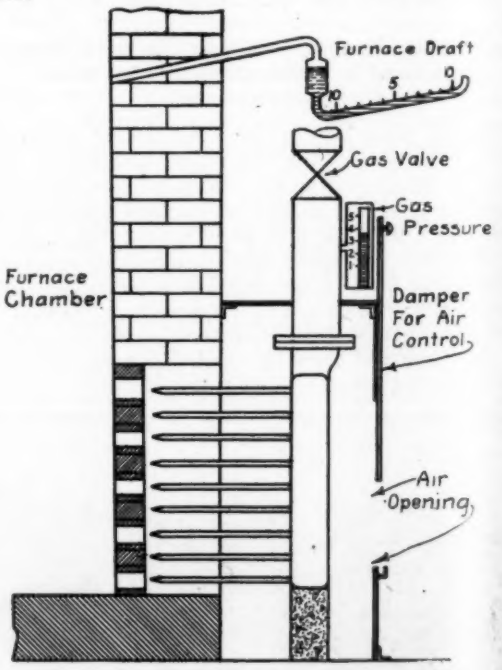
CLOSE MANUAL CONTROL OF GAS BURNERS.

Arrangement for Maintaining Ratio of Air to Gas Constant for High CO_2.

Conservation of coal and oil by burning them efficiently has been discussed from almost every angle for many months. In many localities natural gas is used in place of, or to supplement, coal. While the gas used in this way saves coal, in too many instances this gas is used far from efficiently and too often extravagantly.

The waste of gas is due to incomplete combustion because of careless control or lack of control of the air required for combustion. As often as not the burners do not permit of air control to any degree of certainty; and in many cases the firemen have no way of telling whether the proportion of air to gas is correct or not. The accompanying sketch shows a method of controlling the air supply of gas burners that possesses almost all the features the average gas burner lacks. The boiler front, or rear, or wherever the gas burners are installed, is what amounts to steel-encased. This is obtained by installing a sheet iron wall along and around the burners. A damper or several, according to the number of burners used, also of sheet iron, is installed to permit varying the air entering the burner chamber.

The arrangement shown permits of absolute control of the gas at all rates of combustion or boiler output. At low ratings or with low gas pressure CO_2 can be regulated for; and burning back does not occur. As both gas and air are entirely under the fireman's control changes in the rate of steam-making can be varied very quickly and yet without change in combustion efficiency. Although gas and air are kept separate up to within a very short distance of the furnace, thorough mixing of a very fine subdivision occurs.



Arrangement of Gas Burner for Accurate Control of Air.

The U-tube shown in the illustration, connected direct to the gas chamber between control valve and mixing nozzle, enables the correct ratio between gas and air to be maintained. The correct position of the air damper is obtained by test for various conditions of gas pressure, and the damper so marked. The drop in pressure between boiler room and furnace is maintained constant, hence the quantity of air depends upon the position of the damper. In this way close, accurate and efficient control of air is obtainable at all times, conserving gas and making for economy.

MODIFIED BUTT TREATMENT OF POLES.

A large Ohio central-station company maintaining an extensive distributing system employs a modified form of butt treatment for its poles. This company

uses the brush treatment, claiming it cheaper yet sufficiently effective in prolonging pole life than the dip process.

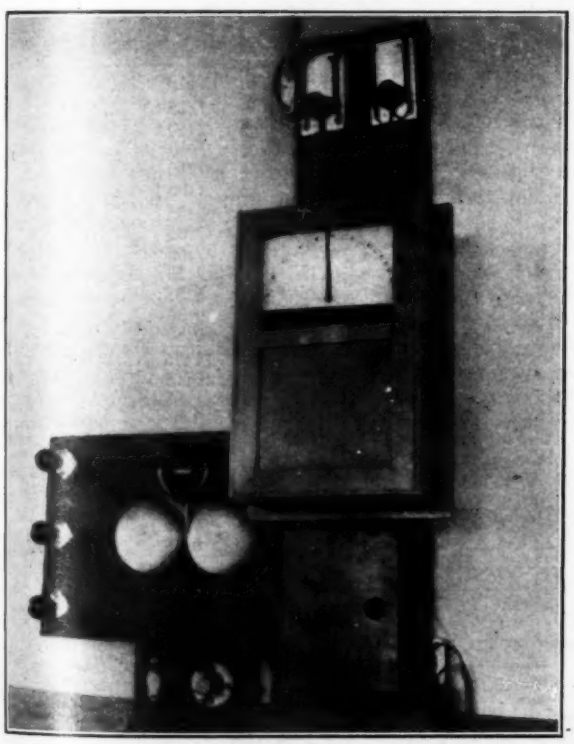
This company, however, does not treat its poles the entire length of the butt buried in the ground plus a section above. Instead, it leaves some 6 to 8 in. at the end of the pole unpainted, and extends the preserving coating 12 to 15 in. above the ground level. The reason advanced for this method of butt treatment, and the company claims its experience bears out its contention, is that moisture is able to escape from the unpainted butt extremity instead of being partially impounded.

The company finds under these circumstances a pole lasts longer in usefulness because the short end after years of use may be cut off and the pole still have sufficient length for use again, whereas had a longer portion of the buried pole rotted, the pole would be too short after removing the rotted part.

NOVEL METHOD OF READING WATER METER AT A DISTANCE.

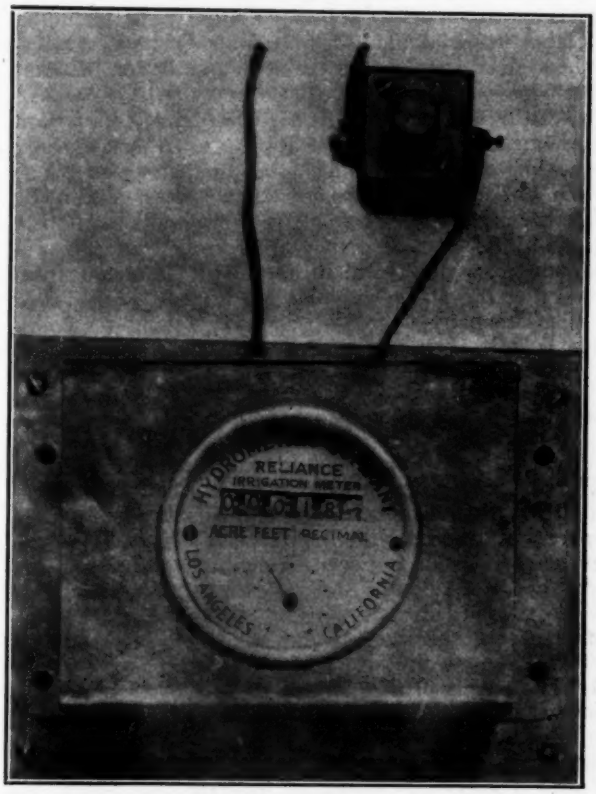
Device Used in Irrigating Systems Also Applicable in Power Stations.

An electrical indicator has been designed by means of which water meters can be read at a distance of 6 miles. An irrigation company may have a canal or ditch, with several laterals leading from it, that are several miles apart. By means of this device a central



Electrical Recording Device for Measuring Water.

office may be connected with each of these laterals, and can know the exact amount of water that is passing through any of the laterals. The central office is also informed by the indicator the total amount that has passed through any lateral. By means of another electrical device the valve leading to the laterals can be opened or closed from the central office, making it unnecessary to send an employee to open or close the valve or to read the meter. It can readily be seen that this is a great labor-saving device. When it is not necessary to know the total amount of water that has passed through the meter, the common telephone can be used. In this case the telephone is connected with the meter in such a manner that each time the meter makes one revolution, a click is heard in the receiver of the 'phone. By knowing the capacity of the meter,



Recording Device Connected to Water Meter.

and ascertaining the number of clicks to a minute, it is an easy matter to figure the approximate amount of water that is passing through the meter. If a sufficient amount is not passing through the meter, the other electrical device may be manipulated and the valve opened until the proper amount is delivered through the meter. A number of meters may be connected to the ordinary telephone receiver, by providing an ordinary telephone switchboard, and plugging in on any line.

RECLAIMING OF BOILER TUBES.

Method in Vogue by Toledo Railway & Light Company Proves Effective and Economical.

Whenever feasible, all bagged and leaking boiler tubes at the Water Street station of the Toledo Railways & Light Company are being salvaged by welding with the oxy-acetylene torch. This method is proving very successful and has proven a great time and money saver over the old way of replacing the leaking or bagged tubes.

Speaking of the process and method employed, William Long, superintendent of production, says: "Our method is to first heat the bag on the tube with the oxy-acetylene torch, using a slow heat until the

bag is a bright cherry red. The bag is then driven back, beginning at the outer edge of the bag and working in toward the center. In case the bag has a hole in it it is first welded shut, after which it is heated to a bright cherry red and then driven back.

"As high as 14 welds have been made on one tube before removing it.

"We are also welding on sections of boiler tubes to straight tubes which have been removed for any reason, thereby reclaiming the tube. The cost of welding is approximately 75 cents per single weld, including all labor material and cost of setting up the apparatus. When several welds are made in one boiler the unit cost per weld is greatly reduced.

"At the suggestion of R. A. Washburn, boiler plant foreman at Water Street station, we are successfully annealing crystallized boiler tubes by the oxy-acetylene torch where the tubes are crystallized on the ends. The tube ends are heated to a bright cherry red and allowed to cool. After cooling they are re-rolled and given a hammer test and found to be as soft as a new tube. By using the above methods the Toledo Railways & Light Company is making a great saving on boiler tube cost."

NOTES ON TURBINE BLADING.

The blading required for the two salient types of turbines, namely impulse and reaction, differ widely. The former must be massive sections and the latter light sections. The strain in the blades due centrifugal force is the same with both types of blades. In the event of collision between blades, however, the more massive blades will suffer less than the less massive blades. But more important than the centrifugal stresses are the stresses due vibration in the steam flow.

The quality of the material composing turbine blading is an important factor in determining the ability of the blades to withstand fracture under vibrating stresses. Homogeneity is of vital importance therefore. Experience seems to indicate that while the strength of a section under tension depends upon the average strength of the fibers, the ability to resist vibration probably depends upon the strength of the weakest fiber.

ANGLE-IRON CROSSARMS.

Inexpensive, Flexible Form of Construction for Three-Circuit Pole Line.

The Dayton Power & Light Company is using a rather unique form of pole line construction for some of its most recent extensions. One such is the line recently constructed to Germantown, which is being used very largely for supplying energy to the Miami Conservancy District's reclamation project.

The pole line construction, which is shown in the

The pole line construction, which consists of metallic crossarms, aims to permit of simple construction, is cheap and permanent yet that has high salvage and is compact so as to permit carrying three 6600-volt, 3-phase circuits on one pole when needed. The circuits carried by the above form of poles may be three 3-phase, 6600-volt circuits and below them a number of 2300-volt feeders may be carried.

iron. The top prong, fastened to the pole tap, forming an apex to an equilateral triangle with the insulators on the top crossarm, makes up the top 3-phase circuit. The three crossarms are of angle-iron. The top arm is 7 ft. in length; the two lower arms are each 12 ft. The arms are placed 42 ins. apart, while the insulator spacing follows the recommendations of the N. E. L. A. Handbook of Overhead Line Construction.

With this form of construction the top circuit necessitates using the short crossarm and the prong The other two arms are added if and when necessary. By installing the one or two lower circuits in the horizontal plane sufficient space exists below even the third 6600-volt circuit for 2300-volt feeders.

It is efficiency all the time that counts. Sporadic effort at economy influences but little annual or weekly performance. Only by sustained economy and continual watchfulness is high average efficiency obtained.

Street Lighting Schedules for October.

Every plant operating street lighting circuits must have a definite schedule for lighting and extinguishing the lamps. Below are given the two most commonly used schedules as compiled for next month. The table is compiled for latitude 40° North. During October the daylight-saving plan of having all clocks set one hour ahead of standard time will be followed until 2 a. m. on Sunday, October 27; therefore the time given in the following table (instead of being mean local or solar time, as is usually indicated in general street lighting schedules) has been advanced one hour in each case up to 2 a. m. during the night of October 26, after which ordinary standard time is followed. The change back to standard time is indicated by the horizontal lines in each column.

OCTOBER, 1918.

Night of Oct.	All-Night Schedule. Light.	All-Night Schedule. Extinguish.	Moonlight Schedule. Light.	Moonlight Schedule. Extinguish.
1	7:15	6:25	7:15	5:25
2	7:10	6:25	7:10	5:55
3	7:10	6:30	7:10	6:00
4	7:10	6:30	7:10	6:00
5	7:05	6:30	7:05	6:00
6	7:05	6:30	7:05	6:00
7	7:05	6:30	7:05	6:00
8	7:05	6:35	7:05	6:05
9	7:00	6:35	7:50	6:05
10	7:00	6:35	8:35	6:05
11	7:00	6:35	9:30	6:05
12	6:55	6:35	10:30	6:05
13	6:55	6:40	11:35	6:10
14	6:55	6:40	11:45	6:10
15	6:50	6:40	1:55	6:10
16	6:50	6:40	3:05	6:10
17	6:50	6:45	4:20	6:15
18	6:45	6:45	No light	
19	6:45	6:45	No light	
20	6:45	6:45	No light	
21	6:45	6:45	6:45	8:15
22	6:40	6:50	6:40	9:10
23	6:40	6:50	6:40	10:10
24	6:40	6:50	6:40	11:10
25	6:40	6:50	6:40	12:15
26	6:35	5:50	6:35	1:20
27	5:35	5:55	5:35	1:20
28	5:35	5:55	5:35	2:20
29	5:30	5:55	5:30	3:15
30	5:30	5:55	5:30	4:15
31	5:30	6:00	5:30	5:10

Tables for each month of the year, rules for the two schedules given above and for modifications of them, corrections for standard time and latitude, monthly and **yearly** total hours of burning for the five most common schedules, as well as other information pertinent to the subject are printed in a booklet obtainable from the ELECTRICAL REVIEW for 25 cents a copy.

Contracting-Construction

Further Comment on Fishing—National Safety Code Being Revised—Installing Heat Regulators—Rigging Support

A FEW FACTS ABOUT CONDUIT FISHING.

Connecting Fish Wires in Two-Way Fishing—Straightening Fish Wires—Guiding Tape in Fishing.

By Terrell Croft.

[*This is the fifth of a series of seven articles by this well known author in which he describes and illustrates the best methods and equipment for fishing conduit. On account of the increasing use of conduit systems, this matter is steadily becoming more and more important, so that a discussion of the subject is of timely value.*]

Loops Tied in Fish-Wire Ends are often effective in two-way fishing. Figs. 16, 17 and 18 illustrate the principle. In Fig. 16 the loops consist of lengths of No. 18 bare copper wire bent and twisted so as to

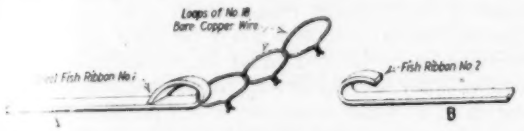


Fig. 16.—Copper-Wire Loops in Fish-Wire End to Promote Ready Engagement.

form a chain. These are attached to an eye bent in the end of one fish wire or tape, A. The end of the other fish wire *B* is formed into a hook. When the two fish wires thus prepared are forced together within the duct and one of them is turned and pulled to and fro, an engagement can usually be made. Loops of cord instead of wire are sometimes used. These may be tied in the eye as shown in Fig. 17, each loop being separate and distinct. However, the scheme described in Fig. 18, wherein one continuous length of cord is formed into a number of loops in the eye, appears to be preferable. In drawing from the duct two fish wires, which have been used for two-way fishing, it is customary to pull out on the shorter wire which is

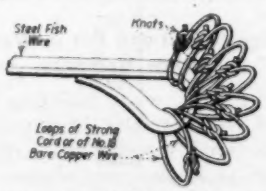


Fig. 17.—Another, But Undesirable, Method of Arranging Loops in Fish-Wire End.

engaged with the longer one. Simultaneously a helper should feed the long one into the conduit at the other outlet so that the pulling stress on the short wire will not be excessive.

To Straighten a Fish Wire or Ribbon a rig similar to that diagrammed in Fig. 19 may be used. After any fish wire has been in service for some time it becomes "kinked." Short kinks in the wire interfere with its progress inside of the conduit. The straightening arrangement of Fig. 19 consists merely of a wooden block *B*, into which nails *N* are driven. At one end of the block is a staple or double-pointed tack *T* through which the wire to be straightened *W* is threaded. The nails are driven in two parallel rows somewhat out of line with each other. The distance between these rows is exaggerated in Fig. 19 in order to better illustrate the principle. For steel fish

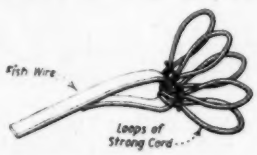


Fig. 18.—Cord Loops Tied on End of Fish Wire for Two-Way Fishing.

wire or ribbon, the distance between centers of rows need not ordinarily be much greater than the width of the ribbon or the diameter of the fish wire.

To straighten the wire *W* it is merely pulled for its entire length around all of the nails through the eye *T*. Considerable force is imposed on the block while the wire is being pulled, hence, it is desirable to fasten it securely in the vise, or, as shown, with screws to the top of the bench or some other stationary object. To grip the fish-wire end in pulling it through, a hand vise or a come-along, such as is used for pulling up line conductors, should be clamped on the wire. One of these tools insures a firm grip for the man who is doing the pulling. The helper should be stationed back of the block to feed the wire to it as it is withdrawn from the other end.

Strips of Rattan Are Sometimes Used for Fishing large-diameter tubes. The Brooklyn Edison Company has used lengths of rattan spliced together so as to form a reed 30 or 40 feet long. The reed is used for threading conduits from poles down into manholes and for fishing service pipes into buildings. These rattan fishing reeds are obviously applicable for only relatively short runs, say for 50 to 60 feet where the diameter of the orifice is about 2 inches or greater. A ball, turned from wood and fixed on one end of the reed, insures that that end, that is, the one which is first inserted in the conduit, will pass with minimum

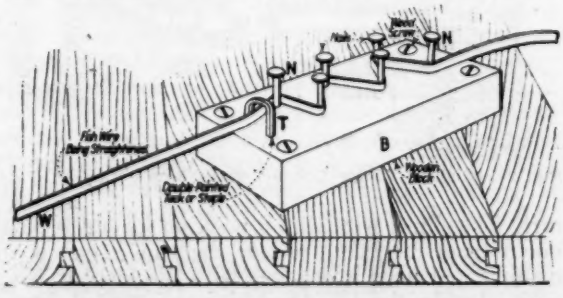


Fig. 19.—Arrangement for Straightening Fish Wire.

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resistance through couplings and past the joints between tubes.

A Guide Tube May Be Used Advantageously in Fishing From Outlet Boxes as detailed in Fig. 20. The tube *T* may consist of a piece, say 2 or 3 feet long, of lead pipe, or of tin tubing such as is used in connecting bar or soda-foundation fixtures. It is necessary that the tube be of a flexible material so that it can be formed readily into the contour required. A guide tube thus used has two advantages:

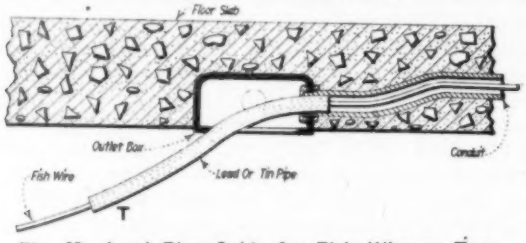


Fig. 20.—Lead Pipe Guide for Fish Wire or Tape.

(1) It prevents the kinking of the fish ribbon in the outlet box, thereby forcing the ribbon directly into the conduit.

(2) Where wall outlets are located so high above the floor that a ladder would ordinarily be necessary to reach them, the guide tube can, when fishing, be inserted into the duct entering the outlet box by reaching up from the floor. The use of a ladder is thereby rendered unnecessary. The tubing where thus used will guide the fish wire or tape squarely into the conduit.

The Fishing of a Large Conduit with a Smaller Jointed Tube is disclosed in Fig. 21. This method is applicable only for large-diameter conduits where the greater part of the run is straight. That is, the distance *L* (Fig. 21) may be considerable provided it is, except at its extremity, straight. The method consists in pushing through an elbow fitting, *F*, located at one end of the run to be fished, a jointed length of ½-inch conduit. Sufficient lengths are screwed together successively as this "rod" is forced into the tube. Hooked over the far end of the jointed tube thus inserted, is a length of No. 1 rubber-insulated wire which is drawn into the duct as the pushing proceeds. After the jointed tube has been forced into the duct to a

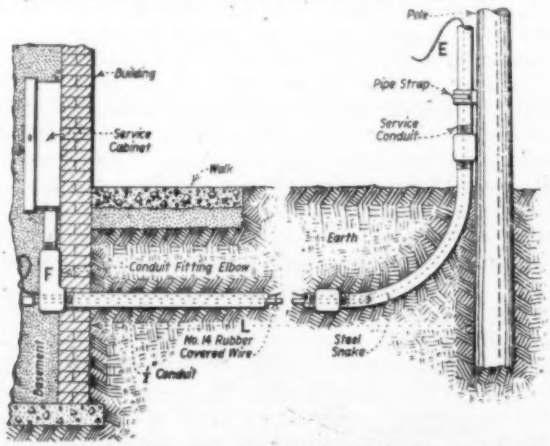


Fig. 21.—Fishing Large Conduit With Small Pipe or Tubing.

turn, a steel fish wire with a hook on its end is pushed down from the other end of the run *E*. It is then manipulated until it engages with the loop of No. 14 wire whereby the No. 14 conductor is pulled through. The No. 14 wire then serves as a pulling-in line. Lengths of ½-inch conduit which have been prepared for the long-distance boring tool described in the author's "Wiring of Finished Buildings" may be used for rodding a duct by the method just described.

In Fishing Wires Through Fixtures a lead weight on the end of a cord is ordinarily the arrangement used. The fixture tube can be held in an approximately vertical position while the fishing is being done so that the weight will be pulled through by gravity. Such a weight is called a "mouse." A number of different designs of this tool and its applications are described in the author's "Wiring of Finished Buildings."

(To be continued.)

REVISION OF NATIONAL ELECTRICAL SAFETY CODE UNDER WAY.

Revised Rules of Part 3 Being Submitted for Comment and Further Suggestions.

The present edition of the National Electrical Safety Code, designated as Circular No. 54 of the Bureau of Standards, has been exhausted and before reprinting it the text of the rules will be revised. This revision is now under way and the Bureau of Standards is anxious to secure from all interested parties comments and suggestions for change of or for additions to the present rules which will improve them. Changes to be adopted must be such as will reduce accident hazards and must be reasonable and practicable. They should be supported by citation of specific instances or other evidence when possible, and should be addressed to the Bureau of Standards, Washington, D. C.

A list of proposed changes to Part 3 of the Safety Code has already been prepared and copies have been sent to the committees of technical and utility associations, state commissions and others who have been co-operating with the Bureau in the formulation and revision of the rules.

Part 3 of the Safety Code contains rules for the safe installation of electrical utilization equipment and is therefore of special interest to electrical contractors. Part 3 was reproduced in the ELECTRICAL REVIEW, issues of March 16 to April 20, 1918, inclusive.

Similar lists of proposals for the other parts of the Code are now being prepared.

HELPING CONTRACTOR TO INSTALL HEAT REGULATORS.

Unique Campaign to Sell and Put in War Time Electrical Home Necessity.

In these war days, when building activities are so much curtailed, owing to the shortage of labor and the high cost of material, the electrical contractor is sometimes hard put to know just where and how he can keep his business going.

Electrical thermostatic control of heating plants has long been recognized as the only proper way of controlling the dampers on furnaces in residences, but, like a good many other electrical conveniences, it has taken the stress of war times to emphasize the point.

Everyone has learned in the school of experience during last winter that the supply of coal cannot be furnished "as usual" in war times and practically everyone has awakened to the fact that every advantage should be taken of all the methods and means that are at hand, to make the family coal pile go as far as possible.

A good many contractors are now engaged in con-

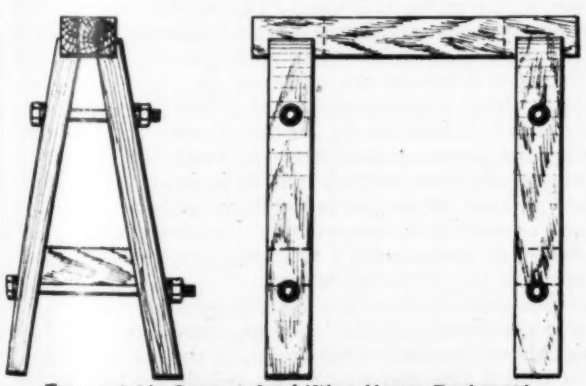
ducting an aggressive campaign to secure orders for heat regulators. All homes that have furnaces are prospects for this equipment, as there are two models available, one of which obtains its operating power from the electric light mains; but the home does not have to be wired for electric service, for there is another model available that operates on power obtained from a clockwork motor. In both types electric signaling is employed between the thermostat on the first floor and the motor box in the cellar. Either type makes a neat and satisfactory wiring job for the contractor.

The Western Electric Company has put out two types of heat regulators, and is ready to furnish the contractors with a complete line of literature to assist them in closing orders. One of the pieces of literature is an interesting pamphlet entitled "Some Facts on How to Run a Furnace and Save Coal." This contains extracts from the technical paper No. 199 published by the Bureau of Mines, Department of the Interior, Washington, D. C., also extracts from the bulletin published by the University of Illinois, Engineering Experimental Station, and extracts from the bulletin published by the University of Wisconsin, University Extension Division.

This publication is a rather unique piece of selling literature, as practically only two pages are devoted to describing the apparatus, whereas ten pages are devoted to explaining to the householder how to keep his home comfortable, and at the same time economize on the fuel.

TRANSPORTABLE RIGGING SUPPORT FOR RAPID MOVEMENT OF HEAVY APPARATUS.

The heavy machines now employed, such as the 4000-kilowatt rotary converter, and the out-of-the-way places in which they are often installed, as in the basements of buildings and even sub-basements, and the



Transportable Support for Lifting Heavy Equipment.

springing up of many substations in utility and customers' premises have made it most important to be able to move equipment rapidly from place to place with a minimum of apparatus and effort.

It is sometimes necessary to lower apparatus weighing 20 tons, more or less, through sidewalks or into station basements. While the work only requires care and the right equipment, it is always desirable to make the undertaking as simple as possible and use as few pieces of rigging and tackle as feasible.

The sketch shows a "horse" that one large central station company has used for several years with success. As seen, the horse consists of wooden members bolted together. There are ten pieces of wood in all, with the necessary bolts and washers. The horse is collapsible, that is, may be dismantled for transport and erected for actual work at the job. The chain falls or rope and block and tackle are hitched to the cross beams at the top after the horse has been erected and mounted over the machinery to be lifted or lowered into place. The size of the members and timbers depends upon the maximum weight to be lifted, as does also the clearance of the cross beam from the floor. In making up such a piece of apparatus it is advisable to choose a height sufficient to permit the highest piece of equipment to stand underneath the horse, if possible. On the other hand, the minimum height of the building in which the horse will stand should also be taken into consideration.

The above horse is readily carted from place to place, occupies little space when dismantled, and one man is able to easily move any part and erect the whole for handling equipment up to 20 tons. Such a piece of rigging tackle will be found useful where heavy machinery has to be moved on short notice from place to place whether for inspection or repair.

AMONG THE CONTRACTORS.

Walter W. Rowe, 30 Cornhill street, Boston, Mass., will do the electrical work in the new business block to be erected at 119-23 Water street in that city.

E. J. Reid, 116 Broad street, New York City, will do the electrical work in the store and apartment building at 5-7 East 54th street, now undergoing improvements.

The Jagger-Sroufe Company, Portland, Ore., has been awarded the contract to wire and install electrical equipment for several ships being built by the Pacific Marine Iron Works, of Portland.

I. L. Watson, 147 Summer street, Boston, Mass., has received the contract for electrical work for the new $40,000 housing development project of the Slatersville Finishing Company, Slatersville, R. I.

The Art Gas & Electric Fixture Company, Jersey City, N. J., has received a contract from the Provost Realty Company for electrical work in the new seven-story and basement cold-storage plant now being erected on Thirteenth street in that city.

Edward B. Stott & Company, Inc., electrical contractors, 461 Eighth avenue, New York, N. Y., have received a contract for electrical work in the five-story building at 23 William street, operated by Delmonico's restaurant.

Paul H. Jaehnig, Inc., electrical contractor, 109 Bank street, Newark, N. J., has received the contract for electrical work in the new $30,000 warehouse building now in course of erection on Wilson avenue by the American Oil & Supply Company, Lafayette street.

George R. Cooley Electric Company, Seattle, Wash., which has the contract for installing the electrical equipment on 27 steel ships being built by Duthie & Company, of that city, has completed the work on ten of them, the work on some of the others being in progress. The contracts require wiring in water-tight conduit, and the installation on each ship of two 15-kilowatt generating units for ship lighting, wireless apparatus and service motors. In some cases these consist of DeLaval turbogenerators, others consisting of General Electric generators driven by reciprocating engines.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 437.—TROLLEY FEEDERS.—The outer braid covering of feeder cables for trolley lines has a tendency to go to pieces after a few years, causing the same to hang down in dilapidated condition and affording excuse for complaints of unsightliness along the streets. Would painting or other treatment of the braid prevent this trouble and extend its life? Since trolley wires are bare, why is there any greater need of covering the trolley feeders which are much less likely to fall down?—J. C. N., Seattle, Wash.

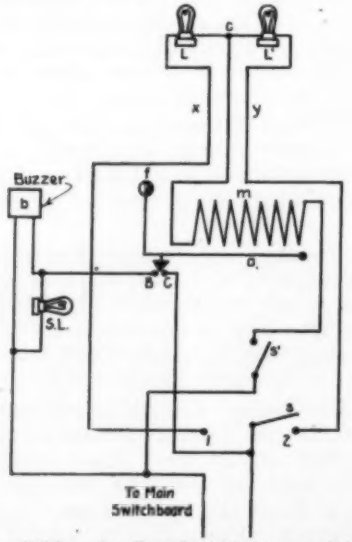
No. 440.—SUBMARINE CABLE TO ISLAND.—Current for electric light is to be supplied to an island about one-half mile from shore. The intervening channel is navigable and is used as a shelter harbor. What is the best way to protect the submarine cable supplying the island so that it will not be damaged by dragging anchors of boats anchored in the channel harbor?—T. R. P., Pensacola, Fla.

Answers.

No. 435.—SIGNAL LIGHTS ON SHIPBOARD.—Where the red and green running lights and the foremast light on a ship are electric lights, what arrangement is made to insure that no lamps have been burned out?—T. A. M., Racine, Wis.

[The first answer to this question appeared in ELECTRICAL REVIEW of September 7, 1918.]

Answer B.—On the Atlantic seaboard, steam vessels of the larger tonnages are equipped with signal or running lights, as follows: Port and starboard sidelights, masthead light, range light and stern light. As these lights are required solely for night navigating purposes, they are controlled from the pilot house. Mounted on a slate panel in that room are five relays, a buzzer and a two-candlepower lamp. In the face of the cover of each relay is a "peek-hole" or window



No. 435.—Wiring for Running Lights on Shipboard.

through which the flag or target *f* may be seen, and each of the relays is equipped with switches, as is shown in the accompanying diagram. Two lamps are connected in each lantern, as shown. To operate it is necessary to close switch *S* either way and also to close switch S^1, thus putting solenoid or relay *m* in series with one of the lamps, and at the same time lifting up the armature *a* which displays the white portion of the flag at the above mentioned peek-hole or window. Should the circuit be opened by the breakage or burnout of the lamp, the armature *a* is released and by dropping, displays the red portion of the flag at the window and at the same time closing the contacts *B* and *C*, thus causing the buzzer *b* and the signal lamp *SL* to operate. By throwing the switch *S* to the reverse position the other lamp is lighted and the trouble signal cut out. It is up to the ship's electrician to see to it that the burned-out lamp is replaced in order to save trouble in case the second lamp also burned out.—W. F. P., Quincy, Mass.

Answer C.—The simplest method of insuring continued operation of the running lights is to put another lamp in series with each. These series lamps are mounted on a "telltale" panel in the pilot house or sometimes in the engine room, if the boat is a small one. If either the running light or telltale light burns out, the latter will indicate this by ceasing to burn. The electrician or engineer must then put another new lamp in the telltale board; if this does not burn, it shows that the running light is the one that must be replaced; if it does burn, it shows that the running light is O. K. and telltale light was burned out. This system is very simple and easily understood and therefore meets the needs of small vessels. The telltale lamps may be low-voltage lamps, say 6-volt automobile lamps of such size or current capacity that they can operate properly in series with the running lights. The latter must be of such voltage as to burn properly in series with the small telltale lamps.—J. B., Galveston, Tex.

No. 438.—RELIABLE SAFEGUARDING OF FLATIRONS.—What is regarded as the most reliable method of safeguarding an electric flatiron so that it will not constitute a fire hazard when left indefinitely with the current "on"?—T. H. W Yonkers, N. Y.

Answer A.—This matter has been a serious problem to insurance interests. The electric flatiron, because it shows no simple visible evidence of whether the current is "on" or "off," is frequently left without having the current cut off when the operator is suddenly called away to answer the door bell, telephone, etc. If left indefinitely on the ironing board in this way, the iron becomes hotter and hotter and eventually reaches the temperature where it ignites the fabric being ironed or the padded surface on the board. Many serious fires have started this way and, though most such fires have caused a relatively low loss, the aggregate loss has been very heavy.

Various schemes have been suggested and tried out to prevent this trouble. Among these are pilot-light signals to show when the circuit at the outlet to which the iron is attached is still live, switches on the handle of the iron to cut off the current when the pressure is released, safety stands on which to place the iron when not in service, automatic thermostatic switches on the irons to cut off current when too high a temperature is reached, etc. Every one of these schemes has objections and none can be said to be a complete and always reliable solution of the problem.

There would be no problem if we could teach the users of irons not to be forgetful of the danger of leaving them with current on. Primarily, therefore, it is a question of education. Heretofore, there has been very little effort on the part of central stations and other dealers who sold irons direct to the public to caution the latter on this point. Lately an effort has been made in some quarters to urge care against

needless waste of current when the iron is not in actual use. Central stations and dealers have usually feared to mention this matter lest their customers get the impression that electrical appliances are very hazardous, and similarly mentioning the need for economy may impress others that such appliances are very wasteful. However, a candid and careful statement of the facts can do no one harm. It should and doubtless will do much good in reducing the hazards, of which most purchasers of irons have never heard, and that without diminishing the sale or proper use of electric flatirons.

Aside from educational work, however, use of some of the safeguards is desirable. Since so many irons are connected to ordinary lighting fixtures, the use of pilot lights on permanent wall outlets will not solve the trouble until fixtures are made of such type or placed so high that attachment of appliances to them is impossible; there are other reasons why such attachment to fixtures should be discouraged, but it is too general and convenient a practice to be changed in the near future. Some of the other schemes are not very reliable and have the objection of higher first cost and upkeep. An approved stand on which to place the iron is a very simple and inexpensive help in this direction. The writer believes that for every flatiron sold there should also be sold a proper stand. This will go a long way, especially if the dealer explains in simple way why it is desirable to use a good stand. But no stand or pilot light will prevent a person from being forgetful, so the most important thing to do is to caution purchasers and users about the possible danger of leaving the iron without cutting off the current. The same danger in increased degree exists with the self-heated gas iron, but the other objections to such irons have greatly retarded their use, consequently in the aggregate the gas irons have not been so big a danger.—B. F., Riverside, Ill.

Answer B.—We have a number of 6-lb. electric irons in continued use at intervals of about 10 minutes for about 30 seconds' duration throughout a 10-hour day. Under our conditions of operation, it is necessary to have them hot and ready to apply at all times. Each iron is equipped with an automatic stand, is protected by a cutout, double-pole switch, pilot lamp and double-contact plug receptacle so arranged that by the insertion of the plug the pilot lamp is placed in multiple with the iron by means of the double contacts on the receptacle and remains lighted as long as the plug is left in the receptacle. When the iron is placed properly upon the stand provided, a switch on the latter automatically cuts in and through a resistance limits the current to a safe value. The action of this device, of course, depends upon the placing of the iron upon the stand. We have tried automatic handle switches on our irons, which kept the circuit closed only while they were in use, but abandoned them as impractical, as were thermostats.—M. K., Passaic, N. J.

No. 439.—MOTOR-STARTING TROUBLE.—We have a 50-hp. three-phase induction motor direct-connected to a large ventilating fan. It is a 60-cycle, 220-volt machine controlled by resistances in the secondary circuit. In starting the motor recently we have noticed that it starts much slower than formerly, but after it gets up to about half speed and the controller is moved to the next notch it suddenly takes a spurt and comes up to full speed quickly. I thought the trouble was in the grid resistances, but have examined and tested them repeatedly without finding any trouble there or in the connections. What is the probable cause of the difficulty?—D. W. E., Joliet, Ill.

Answer A.—If the motor behaves as described, in all probability the starter is at fault. The fault must lie in one phase of the starting step of the starter because, as soon as this step is cut out by passing over to the next notch, the motor accelerates normally, showing that the winding of the motor is all right. The starting steps of the starting resistance must be carefully looked over. One phase may have a much greater resistance due to a bad contact, or one of the grids may have a rather imperceptible crack which, although not breaking the circuit, increases its resistance considerably, causing an unsymmetrical current distribution between the phases and reacting unfavorably on the magnetic field. A "short" between phases is also possible but not likely, as then the motor would start much faster due to decreased resistance in the starting step. It must also be seen that the insulation of the starter against earth is in good in all phases. Further, inspect the brushes on the slip rings as there may be an incomplete contact which is good only at the more elevated speeds.—H. A., Pittsburgh, Pa.

Answer B.—A phase-wound induction motor which starts much slower than usual and on a certain controller position jumps to normal speed for that position has a fault in either the resistance grids, the leads connected in the starting circuit on grids and controller, or controller contacts used in starting. This fault is such that an undue amount of resistance is inserted in the secondary circuit of the motor and the motor runs slow. The grids, wire in the starting circuit, connections and controller contacts which are employed in starting positions should be inspected thoroughly.—W. H. K., Evanston, Ill.

IMPORTANCE OF TERMINAL LIGHTING.

In an address made by R. E. Harrington, illuminating engineer, General Electric Company, before the members of the Traffic Club, Newark, N. J., on September 10, it was pointed out that of 65 shipping piers and railroad platforms at Newark and New York, 42.6 per cent are poorly lighted, 51.2 per cent are fairly lighted, and 6.2 per cent are well lighted. The speaker, in dealing with the subject of "Speeding up Shipments by Correct Illumination," showed the importance of better lighting at terminal and transfer points as a solution of the freight-transportation problem. Under such conditions, he set forth that there would be fewer accidents, a reduction in the number of thefts, less liability of errors in routing and delivery, and reduced strain on the eyes of employes. He contended that for the minimum illumination on piers and platforms there should be provided from 0.2 to 0.35 of a watt per square foot of floor space; also, that by use of whitewashed walls and pillars, and proper use of shades, the illumination would be considerably improved.

APPLIANCE SALES SUGGESTIONS.

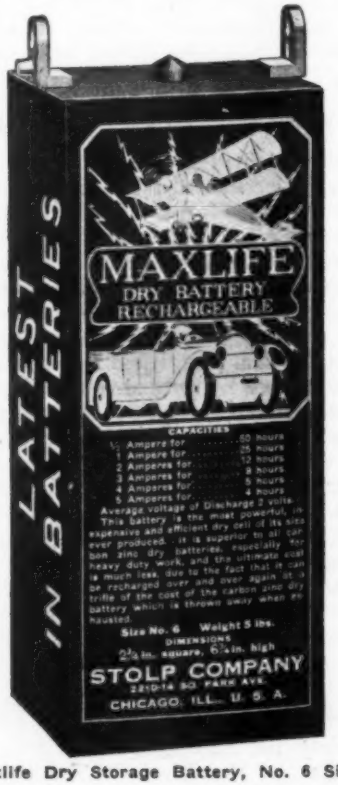
The Society for Electrical Development presents in a recent issue of Monthly Sales Service many helpful sales suggestions for electrical appliance dealers. These are in the nature of special advertisements of various appliances and window-display designs. The advertisements are nearly all illustrated by impressive pictures calculated to create a desire for the electric washer, cleaner and other appliances that relieve the household of old-time drudgery. No two contrasts in the series are more striking than that of the old-fashioned washtub and the modern electric washer. This is shown in a motion picture entitled, "Who Washes Your Clothes?" The designs for window displays are characterized by an effective simplicity that serves to rivet attention upon a limited number of appliances at a time, and are suitable for any sized store.

New Appliances

Rechargeable Dry Cell—Side-Wall Rubbing Machine—New Squirrel-Cage Motors—Coal-Loading Plant—Case Lighting

RECHARGEABLE DRY STORAGE BATTERY.

For many services a dry cell is not only convenient but practically essential, especially where portability is very important. If the service is very severe, however, the short life of a dry cell is its chief handicap. To overcome this efforts have been made at various times to build a storage battery that will have the advantage of the dry cell in portability and yet be easily recharged. Some years ago a type of storage cell combining these desirable features was produced and met with instant demand in large quantities, showing there was a large field for a cell of this type. However, certain difficulties developed which resulted in


LATEST IN BATTERIES
MAXLIFE
DRY BATTERY
RECHARGEABLE
CAPACITIES
½ Ampere for ..... 50 hours
1 Ampere for ..... 25 hours
2 Amperes for ..... 12 hours
3 Amperes for ..... 8 hours
4 Amperes for ..... 6 hours
5 Amperes for ..... 4 hours
Average voltage of Discharge 2 volts.
This battery is the most powerful, inexpensive and efficient dry cell of its size ever produced. It is superior to all carbon zinc dry batteries, especially for heavy duty work, and the ultimate cost is much less, due to the fact that it can be recharged over and over again at a trifle of the cost of the carbon zinc dry battery which is thrown away when exhausted.
Size No. 6 Weight 5 lbs.
DIMENSIONS
2¾ in. square, 6¾ in. high
STOLP COMPANY
2210-14 SO. PARK AVE.
CHICAGO, ILL., U. S. A.

Maxlife Dry Storage Battery, No. 6 Size.

the manufacturer continuing development work. Marked improvement has resulted from this and the battery illustrated, which has recently been placed on the market, is the outcome.

The cell is known as the Maxlife dry battery and is really a storage cell of the lead-plate type, employing pure sulphuric acid of a specific gravity of 1.300 as electrolyte. The lead plates are built on grids of special construction to give very large capacity in the active material, which is held in numerous perforations that give large adhesive contact and at the same time large extent of plate surface. The separators between the plates are made of wood which is specially formed and chemically treated by a secret process. These wood separators and the porous structure of the active material provide the myriad pores that contain the acid. Consequently, the electrolyte is not readily spilled from the battery even when the battery is tipped. The jar is an acidproof container of durable construction and is said to be substantially proof against leakage.

The battery is shipped absolutely dry and before being placed in service must be filled with 11 fluid ounces of chemically pure sulphuric acid of proper density. After standing eight hours to give the plates and separators time to thoroughly absorb the acid, an initial charge at the rate of 1½ amperes is given for 48 hours. The battery is then ready for discharge, which begins at 2 volts or a little above and should not be carried below 1.8 volts. In 6 to 8 cycles of charge and discharge the battery reaches substantially full capacity. At the beginning of recharge one teaspoonful of distilled water is added and the charging rate used is two amperes for 15 hours continuous charge.

This battery is serviceable for any purpose requiring a portable cell, such as automobile ignition and lighting service, miners' lamps and lanterns, railroad signaling, fire and burglar-alarm service, Christmas tree lighting, etc. This battery is manufactured by the Stolp Company, 2210-14 South Park avenue, Chicago, Ill.

A MOTOR-OPERATED RUBBING MACHINE.

To meet the demand for a speedy machine with a good range of action for rubbing and polishing side walls, columns, bridges, subways, etc., the Cavicchi Polishing Machinery Company, of Quincy, Mass., has developed a portable motor-operated machine equal to ten manual workers it is claimed.

The rubbing wheel is on a jointed arm and has a radius of action of 6½ feet vertically from the floor and 8 feet horizontally. The rubbing wheel and the water pump to eliminate dust are driven by a motor made by the General Electric Company.

Springs in the arm counteract its weight and keep the carborundum wheels of the various kinds suitable for the different classes of work pressed against the wall regardless of its irregularity. An ample supply of water is provided by a reservoir in the body of the machine. The outfit can be readily operated and moved from place to place by one man.

NEW INDUCTION MOTORS.

Several new sizes of two-phase and three-phase induction motors have been placed on the market by the St. Louis Electrical Works, 4060 Forest Park boulevard, St. Louis, Mo. These motors are made in two sizes each for 25 and 60 cycles. The 25-cycle motors are made in 10 and 15-hp. sizes for speeds of 1500 r.p.m. and two-pole construction; for speeds of

750 r.p.m. the four-pole construction is used, in which the ratings are 7.5 and 10 hp. The 60-cycle motors, four-pole type for 1800 r.p.m., are made in 15 and 20-hp. size and the six-pole type for 1200 r.p.m. are made in 10 and 15-hp. sizes. Three-phase motors are furnished with 6 leads which are brought out so that the motors can be started by use of the star-delta

St. Louis Induction Motor Mounted on Rails.

starting arrangement. If it is found that this arrangement does not give sufficient starting torque then it is necessary to use a compensator of any standard type.

These motors are of high-grade rugged construction, being designed for practically all classes of service. The construction is as simple as possible so as to reduce the cost while keeping the weight of material employed as high as possible so as to minimize the losses in operation. The efficiency of the motors is therefore very high. The stator is of skeleton type but is of more rigid construction than is usually found in motors of this type. The end plates are very heavy and carry the housing for the bearings, which are of the ball-bearing type. This gives a uniformity of air gap and eliminates the troubles from wear of bearing. The bearing at the pulley end is larger than that at the front end of the motor, and is of such design as to withstand all possible belt pull. The rotor construction is designed to provide a fan for cooling the stator coils. This is done by making the rotor bars extend out from the core of the rotor, this acting also to increase the radiating surface of the rotor bars and keeping the entire rotor and the end rings cool. These motors have exceptionally low iron loss which permits using rotors of somewhat higher resistance without sacrifice to the efficiency of the machine. This higher resistance in turn gives improved starting conditions and reduction of starting current.

NEW ELECTRICAL EQUIPMENT FOR SHIP-LOADING PLANT IS PLANNED.

The Pacific Coast Company, Seattle, one of the heaviest producers and handlers of coal in the Pacific Northwest, has under consideration the matter of installing new electrical equipment at its ship-loading plant in Seattle. At present, electric power for use as direct current is produced at this plant for conveyors, haulage cars and shop tools, and the proposed change contemplates the use of central-station power as alternating current. This change will require complete rewiring of the buildings and yards and the installation of new alternating-current motors, amounting to 500 horsepower. The change also applies to the machine shop operated as a part of the general plant. The new equipment proposed will cost between $35,000 and $40,000.

The five mines operated by this company in western Washington use electric power for haulage, coal-washing and other purposes. In two of these central-station power is utilized. This calls into use motor-generator sets for changing alternating to direct current, the latter being required especially in mine and yard haulage. At other mines the company produces its own electric energy for direct-current motors. Its Burnett mine, where central-station energy is used, was lately equipped with new coal-washing equipment which required two motors of 75 hp. each, and one of 50 hp., which were furnished by Fairbanks, Morse & Company.

GOOD EXAMPLE OF SHOWCASE LIGHTING.

One of the most difficult problems in store lighting is the effective illumination of showcases. It is not easy to get uniform illumination on the goods displayed and frequently the fixtures and lamps used have proven troublesome and expensive in upkeep. An excellent example of showcase lighting is shown in the accompanying illustration which is from a photograph taken in a department store in Hamilton, Ont., Canada. The showcase in the lower part of the picture contains a variety of so-called "notions" that are made to stand out and make a most effective appeal to feminine eyes. In the section of the case shown there are 18 25-watt tubular Mazda lamps in special Benjamin Electric fixtures mounted in the upper front edge of the case so that the direct light is thrown on the goods and not into the eyes of purchasers or passers-by. The wallcase shown above is also fairly well lighted. There being fewer goods displayed, less light is needed here. This case is lighted by 25-watt tubular lamps set every

Good Lighting of Showcase and Wallcase in Canadian Dry-Goods Store.

2 ft. along a conduit in the upper front edge and provided in this instance with a very crude form of tin reflector arranged to cut off all direct light from shining outside the case.

The use of tubular lamps of the size here employed has proven much more satisfactory than use of candelabra lamps which are quite commonly found in showcase lighting. The illumination is much better and the maintenance cost of the entire equipment reduced.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

SPRINGFIELD, VT. — Following instructions from the New England district of the Power Division of the War Industries Board, the Colonial Power & Light Company is arranging to cut down the power supply to some of the local non-essential industries, to provide for increased service to war industries.

MELVILLE, R. I.—The Bureau of Yards and Docks, Washington, D. C., will build a new local radio station, including masts and towers complete, electric apparatus, to cost about $65,000. At Newport, R. I., the Department will install a new electric distributing system at the local naval station to cost $75,000, and has also had plans prepared for a heating system, refrigerating system and cold storage plant at this station to cost about $1,000,000.

HARTFORD, CONN.—Spencer Turbine Company has broken ground for the construction of a one and two-story plant, about 75 by 300 feet, and 40 by 75 feet in size, respectively, on New Park avenue, to cost about $50,000.

BROOKLYN, N. Y.—Columbia Machine Works & Malleable Iron Company, 269 Chestnut street, manufacturer of armatures and other electrical goods, will build a one and two-story plant, about 80 by 150 feet, on Euclid avenue, to cost $50,000. The Austin Company, 217 Broadway, New York, is the contractor.

BUFFALO, N. Y.—Electrically-operated lifting machinery will be installed on the new bascule bridge on Abbott Road, over the Buffalo river, now being erected by the city. The Department of Public Works is in charge.

BUFFALO, N. Y.—In connection with its dye works to be erected on Rustic place at a cost of about $20,000, the Monarch Knitting Company, 19 Doat street, will build a one-story boiler plant, about 30 by 54 feet in size.

BUFFALO, N. Y.—Through the merger of the system of the Federal Telephone & Telegraph Company with the New York Telephone Company, through purchase by the latter organization, the municipal authorities will lose the use of about 100 free telephones, heretofore furnished by the Federal company, and representing a saving to the city of about $5,000 a year.

CAMP MILLS, L. I., N. Y.—The Ordnance Department, Washington, D. C., will have plans prepared for a power plant and laundry house at the local military camp to cost about $300,000. Colonel F. M. Gunby is advisory engineer.

SYRACUSE, N. Y.—The Syracuse Lighting Company has inaugurated a policy to reject all new business until further notice, and no additional extensions or installations will be made excepting for war work. The company says that it is in position to render service to all of its present customers. James C. De Long is president.

SYRACUSE, N. Y.—As a result of improvements and changes in 30 local power plants, as recommended by the local branch of the Fuel Administration, it is estimated that a saving of about 60,000 tons of coal will be effected through this channel alone. The plants comprise about 10 per cent of those in this district.

WATERTOWN, N. Y.—The city has completed plans for its proposed municipal electric plant to cost about $300,000. The station will be located about 1½ miles from the city limits, and will include transmission and distributing system. Thomas L. Tomlines, City Bank building, Syracuse, is engineer.

CAMDEN, N. J.—Fire, September 11, at the works of the New York Shipbuilding Company, destroyed the power plant used for general operation, and plate and angle shop, with loss estimated at about $450,000. It is understood that the structures will be rebuilt immediately.

JAMESBURG, N. J.—The Board of Freeholders has awarded a contract to the Underground Specialties Company, 1476 Broadway, New York, for work in connection with the electric and heating system at the State Home for Boys, at a cost of $24,950.

NEWARK, N. J.—Electric lighting standards will be installed on the series of new safety platforms for trolley stations to be constructed at Springfield; Bloomfield avenue, Bloomfield; Irvington and Glen Ridge, as recommended by the Board of Freeholders. The expense of the improvements will be defrayed by the different municipalities.

POMPTON LAKES, N. J.—The Borough Council has let contracts to the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., and the S. Morgan Smith Company, York, Pa., for two electric generators, switchboard and electrical equipment, and two hydraulic turbines, respectively, for the new municipal electric plant, at a total cost of $21,300.

TRENTON, N. J.—In connection with the rebuilding of the smelting plant of the M. M. S. Metal Company, foot of Fall street, recently damaged by fire with loss of about $25,000 new electrically-operated equipments, including motors, engine and engine plant equipment, will be installed.

WEEHAWKEN, N. J.—Weehawken Tungsten Lamp Company, 340 Hudson street, has had plans prepared for the construction of a new two-story plant on Gregory avenue, about 50 by 80 feet, to cost $10,000.

ALLENTOWN, PA. — Allentown Steam Heating & Power Company has filed a new tariff of rates with the Public Service Commission making an increase of 50 per cent over rates in force last year, to become effective September 28.

CARLISLE, PA.—Bondholders of the Cumberland Railway Company have made application for the appointment for a receiver for the property, holding that the company is now being mismanaged.

CONNELLSVILLE, PA. — The War Industries Board, through the local branch of the Fuel Administration, has ordered the discontinuance of all-day power service to non-essential industries in this section, to provide for increased power supply for coal mining and coke works.

PHILADELPHIA, PA.—Philadelphia & Reading Railroad Company will build two new one-story battery houses at its Erie avenue yards, to be used in connection with two signal towers at this point. Samuel T. Wagner is engineer.

PHILADELPHIA, PA.—A two-story boiler plant, about 48 by 67 feet, will be constructed at the new emergency hospital for the Government, to cost $355,000, on Gray's Ferry road. The Bureau of Yards and Docks, Washington, D. C., is in charge.

PHILADELPHIA, PA.—Through the adoption of power curtailment measures for non-essential industries, department and other stores, and the like, the electric power shortage for war industries has been reduced from 120,000 to 20,000 kw. in this district. The majority of the service is being furnished by the Philadelphia Electric Company.

PHILADELPHIA, PA.— Midvale Steel & Ordnance Company, Widener building, is taking bids for the erection of a one-story brick and concrete power plant at its Nicetown works.

ANNAPOLIS, MD. — The Navy Department has inaugurated service at the new radio station at the local naval site. The station, said to be the most powerful in this country, has an operating radius of 4,000 miles, and represents an investment of about $1,500,000. It has been in the course of erection for the past ten months.

BELHAVEN, N. C.—Twenty-five thousand dollars in bonds have been voted for electric light system. Address mayor.

MT. AIRY, N. C.—The Board of City Commissioners will build a new

electric power plant on the Ararat river estimated to cost about $50,000. Contract has been let for a portion of the work.

SHELBY, N. C.—In connection with the knitting mill to be established by Charles A. Morrison, an electric power drive for machinery will be installed, all machines being motor-driven where possible.

WILMINGTON, N. C.—The new extensions planned by the Tidewater Power Company are estimated to cost about $400,000, and it is understood that such a fund has been arranged by the War Industries Board. The work will include extensions to the company's generating plant to provide for increased power for essential war industries, including the plants of the Carolina Shipbuilding Company and the Liberty Shipbuilding Company. The company operates the Consolidated Railways, Light & Power Company. A. B. Skelding is general manager.

CHARLESTON, S. C.—In connection with the new plant for the manufacture of naval clothing to be erected on a local site by the Navy Department, a power plant for works operation will be installed. The new factory is estimated to cost approximately $800,000. Captain B. C. Bryan is commandant at the local navy yard.

CHARLESTON, S. C.—Charleston Consolidated Railway & Lighting Company, operating the Charleston Consolidated Railway, Gas & Electric Company, has made arrangements with the War Indemnities Board for the financing of proposed extensions in its generating plant and system to cost about $700,000, of which amount one-half will be advanced by the Board. The work will include the construction of an addition to its Charlotte street power station to double the present capacity, the installation to comprise a 5000-kw. turbogenerator, three 500-hp. boilers, condenser, condenser intake, switchboard and other auxiliary equipment, including coal and ash-handling apparatus. An extension will also be made to the present transmission system, as well as power distributing lines to reach various plants now engaging in war work. P. H. Gadsden is president.

ALBANY, GA.—Albany Power & Manufacturing Company, operating a hydroelectric power plant on the Big Muckafoonee river, is planning for extensions and betterments to increase its present capacity. The company is now building a 4000-kw. plant and plans to connect its system with the Columbia Power Company, Columbia, Ala., about 70 miles from Albany. It is understood that this last noted company will also make extensions in its hydroelectric power plant.

MARSHALLVILLE, GA.—Big Indian Power Company, recently incorporated with a capital of $30,000, will operate a hydroelectric power plant and transmission system in this district. It is understood that the company has commenced the purchase of prime movers and other equipment for the proposed plant. Gordon Simmons, Eatonton, is engineer for the company.

DATES AHEAD.

International Association of Municipal Electricians. Annual convention, Atlanta, Ga., September 24-27. Clarence R. George, Houston, Tex.

New England Section of the National Electric Light Association. Annual meeting, Hotel Kimball, Springfield, Mass., September 27 and 28. Secretary, Miss O. A. Bursiel, Boston, Mass.

American Electrochemical Society. Fall meeting, Princeton, N. J. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa.

American Electric Railway Association. Annual meeting, Atlantic City, N. J., October 8 and 9. Secretary, E. B. Burritt, 8 West 40th street, New York City.

Illuminating Engineering Society. Annual convention, New York City, October 10. General secretary, Clarence L. Law, Irving place and 15th street, New York, N. Y.

Jovian Order. Annual convention, Dallas, Texas, October 24-25-26. Mercury, Ell C. Bennett, 1415 Syndicate Trust building, St. Louis, Mo.

Kansas Public Service Association. Annual meeting, Kansas City, Kans., October 17-19. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kans.

NORTH CENTRAL STATES.

BELLEFONTAINE, OHIO.—An election will be held to submit to the vote of the people the question of selling the municipally owned gas and electric plant.

COLUMBUS, IND.—Central Indiana Lighting Company, which also owns and operates the Columbus street railway lines, has petitioned the Indiana Public Service Commission for an increase in fares from five cents to seven cents. The company operates three lines, one to East Columbus, one to Orinoco and one to Maple Grove, suburban towns. If the increase is not granted the company proposes to dismantle the lines and discontinue service.

GARY, IND.—A loan of $203,000 has been granted by the Government to the Gary Street Railway Company and the Gary-Valparaiso railway lines for additional improvements. The apportionment is $170,000 for the Gary railways and $33,000 for the Gary-Valparaiso line.

INDIANAPOLIS, IND. — The Pennsylvania Railroad Company will build an addition to its machine shops at Washington street and Jefferson avenue. Among the improvements will be a blacksmith shop and a boiler shop. An electric traveling crane will be installed and the cleaning vats will be renewed. The cost of the improvements will be $8000.

LAFAYETTE, IND.—The council of LaFayette has come to a tentative agreement with the Northern Indiana Gas & Electric Company relative to a new street lighting contract for the city to take the place of the ten-year contract which expired September 1 of this year. The proposed contract for ten years calls for 2500 hours of lighting for each lamp each year, which is more lamp-hours a year than the "Philadelphia" or the moonlight schedule. The price will be $37.98 a lamp a year, the same price which prevailed under the old contract. The city reserves the right to annul the contract at the end of three, four or five years. If the option is enforced and the contract annulled the city is to pay 10 per cent additional for the street lighting during the time the contract is in force. For lighting for the alleys, parks, water works, engine houses and city offices the city is to pay four cents a kw.-hour.

ALTON, ILL.—The Illinois Public Utilities Commission has suspended until January 15, 1919, the proposed increase in street car rates asked by the Alton, Granite City & St. Louis Traction Company.

DECATUR, ILL.—The council is investigating the matter of securing water power from the new dam. Address Mayor Dinneen.

HAVANA, ILL.—The council is planning ways and means to establish municipal lighting and power plant. Address city clerk.

EAST ST. LOUIS, ILL.—East St. Louis Railway Company has petitioned the Illinois Public Utilities Commission for an eight-cent fare. The city has announced that a vigorous fight will be made on this proposition.

KANKAKEE, ILL.—The Kankakee City Council has approved the petition of the Kankakee Electric Railway Company for an increase in fare from five to six cents, subject to the approval of the Illinois Public Utilities Commission.

MATTOON, ILL.—A six-cent fare for electric street railway service in Mattoon, Charleston and Taylorville, has been recommended by Bert H. Peck, electrical engineer, of the Illinois Public Utilities Commission.

SPRINGFIELD, ILL.—The Illinois State Public Utilities Commission has taken under advisement the application of the Springfield Consolidated Railway Company for permission to charge a flat fare of six cents. The Commission valued the property of the company at original cost of $1,627,500, without including materials, supplies, working capital or allowance for going value. He estimated the gross revenue which would be produced for everybody, including children, at $548,650. Operating expenses are placed at $370,598, with $58,500 for depreciation, a total of $429,183 for expenses.

BARRON, WIS.—Engineer J. C. Jacobson, First National-Soo Line building, Minneapolis, Minn., has prepared estimates for dam to be built by the city. Electrical equipment will be purchased. Address city clerk.

BROADHEAD, WIS. — Power Engineering Company, Corn Exchange building, Minneapolis, has prepared estimates for improvements to the electric light plant. K. Guelson, superintendent of municipal light plant.

KAUKAUNA, WIS.—The pulp mill on the lower water power of the Kaukauna owned by Luther Lindauer has been sold to the Green Bay & Mississippi Canal Company. This company has had plans prepared for constructing a dam across the lower water power which will utilize the full flowage of the Fox river and create another 6000 hp. of water.

LADYSMITH, WIS. — Menasha Paper Company has secured plans from Engineer J. C. Jacobson, First National-Soo Line building, Minneapolis, Minn., for electric machinery at the pulp mill. Address Harry Ballou, manager.

MANITOWOC, WIS.—An appropriation of $57,000 has been made for purchasing electric light equipment. Address city clerk.

OCONTO, WIS.—Engineers Mead & Seastone, State street, Madison, have prepared plans for improvements to be made by the Oconto Service Company. The specifications include water turbine, generator, switchboard, etc. S. C. Pamperlin, secretary.

TOMAHAWK, WIS.—Tomahawk Light, Telephone & Improvement Company will expend $15,000 in improvements.

NEW MUNICH, MINN.—The council will purchase additional electric equipment. Address village clerk.

ST. CLOUD, MINN. — Great Northern Flour Milling Company will purchase electric equipment for operating flour mill. Address manager.

ELKHART, IOWA.—F. E. Tedford of Gowrie, Iowa, has the contract to build a $7300 transmission line and distributing station to furnish light for Elkhart.

HOLDEN, MO.—Franchise has been granted to the Green Light & Power Company of Pleasant Hills to build a transmission line here within the next 60 days. The electric light plant has been recently destroyed by fire.

HUME, MO.—I. H. Smith, president of the Hume Telephone Company, has filed a petition of bankruptcy against the Electrical Power Company of Pleasanton, Kans., which contracted to furnish street lights and 24-hour commercial service for Hume. The idea of a municipal ice and power plant is being agitated.

KANSAS CITY, MO.—A contract of merger between the Kansas City Home Telephone Company and the Bell Telephone Company has been drawn up and is now in New York where it is being gone over by the officials of the Bell company. Final agreement should be reached soon, according to A. F. Adams, president of the Home company.

MILAN, MO.—The electric light plant was destroyed by fire recently.

ATCHISON, KANS.—James W. Orr, local attorney, made a demand before the city council that a receiver be appointed for the Atchison Railway, Light & Power Company, owned by the McKinley syndicate, also known as the Union Traction Company of Illinois, September 4. Attorney Orr represented several big power users which are refusing to allow the poor service to continue.

STERLING, NEB. — Nebraska Electric Light Company will rebuild its plant recently destroyed by fire.

BONE STEEL, S. D.—$14,000 in bonds have been voted for municipal light plant. Address mayor.

MUNICH, N. D.—The question of installing a municipal light plant is under consideration. Address village clerk.

SOUTH CENTRAL STATES.

BIRMINGHAM, ALA.—Birmingham Light & Power Company has been granted permission by the Public Service Commission to increase its heating rates in the city 20 cents per 1000 pounds of steam.

FORT PAYNE, ALA.—Bonds for $6000 have been voted by the city council for the establishment of a municipal electric-lighting plant.

MOBILE, ALA.—The Emergency Fleet Corporation, Philadelphia, Pa., has commenced a local power survey to determine the amount of available electric power for local shipbuidling companies.

FLORENCE, ALA.—Survey has been completed for construction of electric railway between this city and Huntsville, Ala., by Muscle Shoals Traction Company. Paul O. Aikin expected that all arrangements will be completed and that construction will be begun in short time. Wadles & Sons, New York City, engineers.

FORT SMITH, ARK.—Construction of the new unit for the power house of the Fort Smith Light & Traction Company has been practically completed and will be placed in operation soon.

FORT SMITH, ARK.—Glicks Dry Cleaning Company, which recently secured a contract with the War Department for cleaning all army uniforms at Camp Pike, is making plans for a large new dry cleaning plant which will require approximately 200 hp. in motors for operation. This is prospective new business for the Fort Smith Light & Traction Company.

BRISTOW, OKLA.—The council is planning ways and means to secure the installation of new street lights. Address Mayor C. T. Schrader.

ENID, OKLA.—A high tension electric transmission line will be constructed from El Reno to Hennessey, Okla., to serve Okarche and Dover. This line will also serve the purpose of connecting the Enid and El Reno divisions of the Oklahoma Gas & Electric Company, a line already being in operation between Enid and Hennessey.

EASTLAND, TEXAS. — Texas Light & Power Company of Dallas has taken over the local electric light and power plant. It will install additional machinery and equipment and probably construct a system of power lines to various points in this oil-producing district.

SAN ANGELO, TEX.—San Angelo Water, Light & Power Company has agreed to install a modern filtration plant and spend $35,000 on improvements.

WESTERN STATES.

BUTTE, MONT.—Another toll line has been completed between Kalispell and Whitefish, by the Mountain States Power Company, to care for the increasing telephone business between these towns and connecting Missoula and other cities.

BREMERTON, WASH. — City council has passed ordinance specifying and adopting plan for an electric plant for power and light, to be built or purchased; estimated to cost $200,000. Proposition was voted on September 10.

SEATTLE, WASH. — Favorable action has been taken by the finance committee of the Seattle city council, instructing City Engineer A. H. Dimock to proceed with the survey of the Skagit river power project with a view to the immediate beginning of construction work. The first issue of bonds totaling $1,500,000 will be available November 15 and in the meantime it is expected that the necessary funds for the preliminary work will be secured by borrowing from the general fund.

SPOKANE, WASH.—Bates & Rogers, of Spokane and Chicago, have been awarded contract for constructing a nitrate plant at Toledo, Ohio, to cost between $15,000,000 and $20,000,000, and contract for constructing shipyard at St. Andrews Bay, Fla.

TACOMA, WASH.—The United States Government has approved an issue of $300,000 utility bonds for the purpose of acquiring the Lake Cushman power site for the city of Tacoma. Address city clerk.

WALLA WALLA, WASH.—Reported that reclamation service is giving some consideration to the matter of constructing a dam at Five Mile Rapids on Snake river for irrigating several thousand acres of arid land in Franklin and Walla Walla counties and also developing a hydroelectric plant from the power.

EUGENE, ORE.—Eugene city council recently granted to the Pacific Telephone & Telegraph Company a 25-year franchise to maintain and operate telephone system here. Wires in business section must be placed in conduits underground.

EUGENE, ORE.—Pacific Telephone & Telegraph Company has secured franchise to operate telephone system. The wires in its section will be placed in conduits.

PORTLAND, ORE.—Differences over the proposed franchise of the Kenton Traction Company for use of the Derby street approach to the Interstate bridge as right-of-way for its Peninsula Traction line have been settled, and final action will be taken at once by county commissioners.

STOCKTON, CAL.—Western States Gas & Electric Company has accepted contract from the Stockton Wool Scouring Company for 150 hp. in motors covering a period of five years. The installation will displace a steam plant.

PROPOSALS

GENERATOR AND TURBINE.—Sealed proposals for furnishing a 5,000-kw. vertical hydraulic turbine and generator will be received by the United States Reclamation Service, Denver, Colo., October 1, 1918. For particulars address the United States Reclamation Service, Washington, D. C., or Denver, Colo. A. P. Davis, chief engineer.

War Industries Board Ruling on Priority Distribution

Priorities Division of War Industries Board Issues Instructions to Electrical Manufacturers and Jobbers Regarding Essential Distribution—Full Text of Circular No. 23

The Priorities Division of the War Industries Board has issued Circular No. 23, addressed to all electrical manufacturers and resale distributors of electrical equipment, apparatus, appliances and supplies, as follows:

It is in the public interest that all jobbers, wholesalers and resale distributers of, and dealers in, electrical equipment, apparatus, appliances and supplies should be permitted to maintain reasonable stocks from which Government agencies, war industries, contractors and the civilian population may draw to meet *essential* requirements. Such persons, however, should recognize the existing necessity for rigid economy in the use of all such products and their duty to see that such products shall be devoted to essential uses and they should pledge their wholehearted co-operation in a program to accomplish such results.

Jobbers, warehousers and resale distributors (all of whom will be herein referred to as jobbers) through their war service committee have already obligated themselves to assist in securing such results. They will be permitted to maintain reasonable stocks and distribute therefrom as follows:

(1) Each such jobber will execute and file its pledge of co-operation addressed to Priorities Division (mailing same to the Electrical and Power Equipment Section of the War Industries Board). Such pledge of co-operation will be as follows:

PLEDGE OF JOBBERS, WAREHOUSERS AND RESALE DISTRIBUTORS OF ELECTRICAL EQUIPMENT, APPARATUS, APPLIANCES AND SUPPLIES.

Priorities Division,
War Industries Board,
Washington, D. C.

The undersigned hereby pledges itself (1) not to use, nor so far as lies within its power permit to be used, any electrical equipment, apparatus, appliances or supplies, which now are or may hereafter come into its possession or under its control except for essential uses as that term has been or may be defined or applied from time to time by the Priorities Division of the War Industries Board; (2) not to make any sales or deliveries from its stocks except (a) such small sales from shelf stocks as are necessary to meet minor needs of the community which it serves, (b) such sales as are warranted by priority certificates or by automatic priority ratings issued or authorized by the Priorities Division, (c) sales of appliances, the manufacture of which has been approved by circular or express permit of the Priorities Division and for whose sale a pledge has been given by such jobber to the manufacturer thereof, or (d) sales to dealers, contractors, retailers, repairmen or others buying for resale who have filed with the undersigned a pledge in writing similar to this pledge; (3) that, in ordering electrical equipment or apparatus, it will furnish the manufacturer in the manner prescribed by such manufacturer information regarding stocks of substantially similar ratings and types then on hand and the essential character of the sale or sales made justifying the order placed; (4) that it will use its utmost endeavor to reduce all stocks to the minimum consistent with the essential requirements of the territory to be served, to prevent hoarding of stocks, and to insure that they be distributed solely for essential purposes.

When the Priorities Division shall have approved such pledge, the Electrical and Power Equipment Section will issue to such jobber its certificate declaring such jobber to be entitled to avail itself of the benefits of this circular.

(2) To the extent that its sales fall within the limits of the foregoing pledge, a certificated jobber shall be entitled to place with any manufacturers or jobbers constituting its sources of supply, orders, for stock, provided (a) that such orders for stock shall not be in substantial excess of the amounts actually sold from previous stocks; (b) that due regard has been had for such jobber's obligation to reduce all stocks to the minimum consistent with the essential requirements of the territory which it serves, and (c) that each order for electrical equipment or apparatus is accompanied by a statement as indicated in item 3 of its pledge. The Electrical and Power Equipment Section will revoke its certificate issued to any jobber for any violation of the pledge given by such jobber and will certify such revocation to such jobbers suppliers, and the Priorities Division will withhold from such offender all priority assistance.

(3) All orders for stock placed in accordance with the foregoing plan shall be and they are hereby rated as Class B-4 and entitled to priority and precedence accordingly, conditioned, that any certificate holder, when placing any order with any supplier, must have on file with such supplier a copy of the certificate issued to holder by the Electrical and Power Equipment Section.

All dealers, contractors, retailers, repairmen and others buying for resale (all of whom will be herein referred to as dealers), not holding certificates issued by the Electrical and Power Equipment Section (except jobbers whose certificates have been revoked), will pledge their co-operation and will be permitted to purchase reasonable quantities of electrical goods for resale and to distribute same pursuant to the following plna:

(1) Each such dealer will execute and file with each of its suppliers its pledge of co-operation. Such pledge will be signed by the person, firm or corporation owning such business or by an authorized executive thereof and will be in the following form:

PLEDGE OF ALL DEALERS, CONTRACTORS, RETAILERS, REPAIRMEN, AND OTHERS BUYING ELECTRICAL GOODS FOR RESALE.

To .....
City of .....
State of .....

The undersigned hereby pledges itself (1) not to use nor, so far as lies within its power, permit to be used any electrical equipment, apparatus, appliances or supplies which are now or may hereafter come into its possession or control except for essential uses as that term had been or may be defined or applied from time to time by the Priorities Division of the War Industries Board; (2) that, in ordering electrical equipment or apparatus, it will furnish its source of supply, in the manner prescribed by such supplier, information regarding stocks of substantially similar ratings and types and the essential character of the sale or sales made or to be made justifying the order placed; (3) that it will use its utmost endeavor to reduce all stocks to the minimum consistent with the essential requirements of the trade served, to prevent hoarding of stocks, and to insure that they be distributed solely for essential purposes.

(2) All orders placed in accordance with this pledge shall be and they are hereby rated as Class C and entitled to priority and precedence accordingly, conditioned, however, that such dealer shall have on hand with its supplier its said pledge.

(3) Any supplier of any dealer with whom any order is placed by such dealer in accordance with the plan prescribed by this circular shall scrutinize such order carefully in the light of the then relationship of supply and demand generally of the particular electrical goods and the needs of the trade served by the dealer placing such order.

(4) Any violation by any dealer of its said pledge must be promptly reported to the Electrical and Power Equipment Section and such Section will certify such dealer to its suppliers to be no longer entitled to avail itself of the benefits of its priority classification under this circular and the Priorities Division will withhold from such offender all priority assistance.

The War Industries Board will rely upon such certificated jobbers and their war service committee and trade supplied by them to see that the policies mentioned herein are safeguarded as to all business done through such jobbers or which comes under their observation. It will rely upon the manufacturers of electrical goods and trade supplied by them to see that the policies mentioned herein are safeguarded as to all business done by such manufacturers or which comes under their observation.

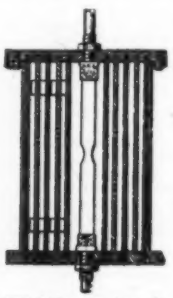
The Government is depending upon the experience and patriotism of all manufacturers, jobbers, dealers and consumers to assist it in securing an equitable distribution of all products and their application solely to essential uses.

Recent Patents

Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

Magnet Core (1,274,952).—Finely divided particles of magnetic material are covered by an insulating coating, and the mass is then formed into a solid body by pressure sufficient to distort the magnetic material beyond its elastic limits.

Inclosed Electric Fuse (1,275,110).—Walter W. Walsh (of Wilkinsburg,



No. 1,275,110.—Inclosed Fuse.

Pa.) surrounds the fuse by a series of split cylinders normally arranged with their gaps staggered, thus forming sound-muffling expansion chambers.

Electric Tempering (1,274,919).—Means for allowing the heated article to expand and for automatically cutting off the heat are provided, according to this patent assigned to the Snead & Co. Iron Works (of Jersey City, N. J.) by Harry P. Macdonald and Edward M. Huggins.

Making Phosphorus (1,274,479).—To recover the phosphorus from slag, Harry O. H. Wenman (of Bishop's Castle, England) runs the molten slag direct from the steel furnace into an electric furnace, supplies silicate and carbon to the electric furnace, and maintains the latter at the temperature required to volatilize the phosphorus.

Telegraphy (1,274,519 and 1,274,520).—For secret telegraphy, Patrick B. Delaney (of South Orange, N. J.) mounts a telegraph key in the base of the stand of a desk telephone transmitter. Then he uses the Morse key in making metallic contact with the transmitter for vibrations representing signal impulses, and for making non-metallic contact for weaker vibrations representing a termination of the signals.

Making Commutators (1,274,411).—The commutator bars are pressed against a yielding insulation, consisting of incompletely cured phenolic resin with such force as to impress them into this material, and the insulating material is then hardened by completing the curing. Patent assigned by Edward A. Halbleib and Thomas L. Lee to the North East Electric Co., of Rochester, N. Y.

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

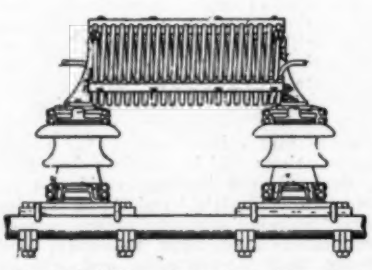
Illuminated Sign (1,274,907).—William Reed-Lethbridge (of Wellington, N. Z.) paints a design on varnish filling the interstices of a screen, so that this design will appear when the screen is lighted from the rear.

Spark-Plug Electrode (1,274,395).—For making the electrodes of spark plugs, Wilbur E. Driver (of East Orange, N. J.) uses an alloy of approximately 2 parts manganese, 3½ parts chromium, and 94½ parts nickel.

Electrical Measuring Instrument (1,274,675). — The volt-ampere-hour meter of this patent, assigned to the Westinghouse Co. by Harold W. Brown (of Ithaca, N. Y.) has two damping magnets governed by a power-factor meter.

Inclosed Fuse (1,274,368).—The casing inclosing the fuse carries a shutter, which is permanently connected to one cap and which can interlock with a removable cap, so that the removable cap locks both in position. Patented by Harry L. Beck (of Pittsburgh), John Weible (of Coraopolis, Pa.), and Jerry J. Houlahen (of Millvale, Pa.).

Choke-Coil Mounting (1,274,555).—The end turns of a choke coil are held

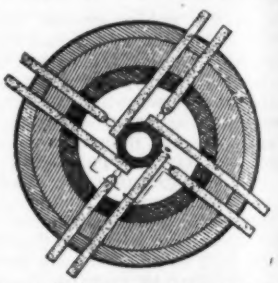


No. 1,274,555.—Choke-Coil Mounting.

by two brackets mounted on insulators. Patent assigned by Ernest H. Jacobs to the Electrical Engineers Equipment Co. of Chicago.

Field Telegraph (1,274,857). — A portable telegraph and telephone instrument in which either a transmitter or a buzzer may be used to send messages. Patented by Frank Pattison Cork, of Audley, Newcastle, England.

Electric Furnace (1,274,796).—The material to be treated is passed through a conduit heated by a series of electric arcs which are all outside of the conduit. Somewhat allied furnaces are also shown in patent Nos. 1,274,794,1,274,795 and 1,274,798, all as-



No. 1,274,796.—Electric Furnace.

signed by Mark Shoeld (of Chicago) to the Armour Fertilizer Works.

Making Aluminum Nitride (1,274,797).—The same Mark Shoeld uses an electric heating current for making aluminum nitride from briquets of carbon, alumina and a binder.

Making Iron Electrolytically (1,275,161).—For this purpose, Axel T. C. Estelle (of Hagen, Germany) treats iron compounds with caustic or carbonic alkali at high temperatures, and then subjects both these compounds and a slime of caustic solution to electrolysis.

Film Socket (1,274,495).—The film, which is punctured when the lamp burns out, thereby maintaining the series circuit uninterrupted, is carried by a film retainer secured to the lamp base. This retainer has projections of restricted area to define puncture points. Patent assigned by Herman H. Ashinger to the George Cutter Co., South Bend, Ind.

Protecting Electrical Apparatus (1,275,151).—To protect an electric winding against the effects of high-frequency energy, Frank C. Green (now deceased) placed separate and permanently closed turns in inductive relation to different portions of the winding, each such turn being closed by a resistance. Patent assigned to the General Electric Co.

Time Relay (1,274,660).—An electromagnet has a main winding connected to a relay and a secondary winding connected to the trip coil of a circuit interrupter. Then means are provided for causing currents to be induced in this secondary winding in accordance with the current traversing the circuit. Assigned by Clayton E. Allen, of Pittsburgh, to the Westinghouse Electric & Mfg. Co.

Men in Service

Charles Piez Appointed Senior Management Officer of Emergency Fleet Corporation—Detroit Edison Honor Roll

J. PAULDING EDWARDS, formerly chief engineer for the Northern Electric Company, was recently commissioned a major in the Aviation Section, stationed at the Aviation Repair Depot at Dallas, Texas.

HARRY ROTHSTEIN, purchasing agent and general manager of the electrical supply department of the Eclipse Light Company, New York City, has enlisted in the service of Uncle Sam and is a member of the U. S. Marine Corps.

TIMOTHY F. HOLT, formerly salesman for the Fullerton Electric Company, Bronx, N. Y., and who enlisted in the Navy, April 1, 1917, has been promoted to the position of second-class electrician aboard the U. S. S. Amphitrite.

F. L. HOLLINGWORTHY, formerly in the distribution and transmission department of the Georgia Railway & Power Company, Atlanta, Ga., has joined the 472nd regiment of engineers and will be in the typographical section of this military organization.

STANLEY N. ABBOTT, office manager and assistant sales engineer of the Hygrade Lamp Company, Salem, Mass., has entered the Officers' Training School for the Ordnance and Quartermasters' Department, and is located at Camp J. E. Johnston, Jacksonville, Fla.

C. C. BALDWIN, Standard Underground Cable Company, Perth Amboy, N. J., has been appointed a member of a committee to confer with the Fuel Administration, Washington, D. C., regarding the proposed thirty-day coal storage plan for bituminous coal in New Jersey.

H. C. BRADSHAW and A. W. WEST, of the engineering division, electrical department of the Georgia Railway & Power Company, Atlanta, Ga., have answered the call to the colors. Mr. Bradshaw has gone to Camp Forrest, near Fort Oglethorpe, and Mr. West is at College Park, Md., in the radio section of the signal corps.

THOMAS K. GLENN, vice-president and a director of the Georgia Railway & Electric Company, also a director of the Georgia Railway & Power Company, Atlanta, Ga., was recently elected a regional chairman of the resources and conservation section of the War Industries Board. This section, No. 12, covers the States of Georgia, Florida and South and North Carolina.

JAMES JOHN KEEGAN, formerly in the employ of the Commonwealth Edison Company, Chicago, and now with Battery F, Sixth Field Artillery, was cited by his brigade commander for bravery under fire on the morning of June 26, when under the direction of Lieutenant Osborn, he fought a fire started by German incendiary shells. Though under a constant harassing fire, and in constant danger from exploding machine gun and 75 mm. ammunition stored in the burning building, he worked steadily for more than two hours, finally bringing the fire under control.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

CHARLES PIEZ, vice-president of the United States Shipping Board, Emergency Fleet Corporation, and president of the Link-Belt Company, Chicago, was recently appointed to the position of senior management officer of the corporation in the executive direction of all its activities, with the title of vice-president and general manager. The

Charles Piez.

change in the designation and jurisdiction of Mr. Piez is, in effect, a promotion for this official, to whom is conceded full credit for having piloted the Emergency Fleet Corporation over the very difficult road of its early career. It places Mr. Piez at the right hand of Charles M. Schwab, director general of the corporation, with executive authority over all matters of policy and operation. He is a graduate of the '89 class of the School of Mines. Almost immediately following his graduation from that institution, he entered the employ of the Link-Belt Engineering Company, Philadelphia, Pa., as a draftsman, and with the growth of the company held successively the positions of chief engineer, general manager and vice-president until 1906, when this company was merged with two affiliated companies in the West, forming the Link-Belt Company, of which Mr. Piez was elected president. Under his able leadership the company has made remarkable progress in its manufacturing and accounting methods, which for the most part were developed by Mr. Piez, have been extensively adopted by other large manufacturing concerns.

LIEUT. F. H. WILSON, who was before his enlistment city electrician of Winnipeg, Canada, and who for the past two years has been a prisoner in Germany, has now been transferred to Holland, and it is hoped that he will be able to return to Winnipeg as soon as victory is won by the Allies.

DETROIT EDISON COMPANY has added 188 names to its roll of honor since the publication of the last list in the May Synchroscope, which at that time carried 367 names. The new list, printed in the September issue, brings the total to 555 Detroit Edison men engaged in the great fight for democracy.

H. J. MEYER, member of the firm of Charles L. Pillsbury, consulting engineers, Minneapolis, Minn., has been appointed engineer of the Minnesota Fuel Administration to act in fuel conservation matters. One of the aims is to utilize all possible power of hydroelectric plants in the state.

RICHARD L. TAYLOR, JR., formerly of the Louisville Home Telephone Company, is now first lieutenant of Company C (the outpost company) of the 310th Field Signal Battalion. He entered the service of the company in January, 1913, as assistant engineer and superintendent of construction, leaving in July, 1917, to enlist in the Signal Corps. Lieutenant Taylor attended the officers' training school at Fort Leavenworth, Kans., and upon completion of the course was assigned to the 310th Field Signal Battalion, Camp Custer.

Obituary.

HAROLD R. SWANTON, formerly of Station No. 3 and Station No. 5 of the Rochester Railway & Light Company, Rochester, N. Y., is the first employe of the company to die in the service of the country. Private Swanton was a member of the United States Naval Reserve Forces at Camp Logan, Texas, and there lost his life through accident.

Personal

C. D. Flanigen Elected President of Southwestern Section, N. E. L. A.—T. F. Johnson Promoted—Other Changes

LYMAN D. MORGAN, formerly with the National X-Ray Reflector Company, Chicago, has accepted a position in Seattle with the Western Electric Company, Inc., as lighting specialist.

H. D. GROS, North Syracuse, N. Y., has resigned as superintendent of the Syracuse & Northern Electric Railway Company. He will be succeeded by Mr. Harry Abbe, formerly superintendent of the Syracuse & Suburban Railway Company.

CHARLES E. DAVIES, superintendent of the Great Northwestern Telegraph Company, Toronto, Ont., has been appointed a member of the Telegraphy and Telephony Committee of the American Institute of Electrical Engineers, for the year beginning August 1, 1918.

J. O. KAMMERMAN has been appointed associate professor in the electrical engineering department of the University of Oklahoma, Norman, Okla. For the past eight years Mr. Kammerman has been in the electrical engineering department of the Pennsylvania State College and has also been engaged in consulting engineering work throughout the State of Pennsylvania.

C. D. FLANIGEN, general manager of the Athens (Ga.) Railway & Electric Light Company, was recently elected president of the Southwestern Section of the National Electric Light Association. Mr. Flanigen was born in Philadelphia, and is a graduate of the Polytechnic College of the State of Pennsylvania, with the degree of B. M. E. He became manager of the Athens Gas Company in 1883. In 1894 he entered the newspaper field as business manager of the Athens Daily Banner. Later he became connected with the Athens Railway & Electric Company, advancing from the position of superintendent to that of general manager, the position he now holds.

T. F. JOHNSON, superintendent of transmission and distribution of the Georgia Railway & Power Company, Atlanta, Ga., has been appointed assistant general superintendent of the electrical department. Mr. Johnson has been with the company eight years. He was graduated from Georgia Tech in 1908, and in 1910 took his engineering degree. In fall of that year he joined the company, working at the Fulton plant, and later went to Morgan Falls, and assisted the Northern Construction Company on a big job at Talllulah. He rejoined this company as head of the transmission and distribution department. The new position of assistant general superintendent has just been created. Mr. Johnson is the inventor and patentee of several devices for handling "hot" wires, including the "Johnson clamp," which have enabled this company to forge ahead of others in construction and repairing transmission lines. His detector for broken insulators is very simple and perfectly effective.

H. KEIFER, recently of Vancouver, B. C., is now with Western Electric Company, Inc., to handle especially the telephone equipment.

A. W. SIEMS, formerly of the firm of Zenker & Siems, New York City, has severed his connection with that firm to engage in the electrical engineering business for himself. His headquarters are at 1358 Broadway, New York City.

JOHN M. DRABELLE, formerly electrical engineer for the Iowa Railway & Light Company, Cedar Rapids, Iowa, was recently appointed mechanical and electrical engineer of the entire system of that company.

HOWARD F. VIOT, manager of the Omaha district of the Shelby Division of the National Lamp Works, was recently appointed manager of the Chicago district for the company, with headquarters at 730 South Michigan avenue, Chicago.

W. W. HENRY, who for 15 years has been connected with the Georgia Railway & Power Company, and for some time acted as special investigator of the engineering division, electrical department, has been promoted to the position of assistant engineer, succeeding Alfred C. Wilson.

JAMES THERON ROOD has been elected professor of railway electrical engineering in the University of Illinois. He graduated in 1898 from the Worcester Polytechnic Institute and received the degree of doctor of philosophy from Clark University in 1906. He served as instructor in physics and mathematics at Ersimus College, 1906-07 and was instructor in physics and electrical engineering in the University from 1907 to 1909. Professor Rood served for nine years as professor of electrical engineering at Lafayette College, Easton, Pa., resigning that position to accept his present work at the University of Illinois.

GEORGE E. PINGREE, managing director of the allied company of the Western Electric Company in London, arrived in this country recently and will probably remain here for some time. In the absence of Gerard Swope, vice-president and general sales manager, who has been called to Washington on Government business, Mr. Pingree will take up that part of his work dealing with foreign and export business, and will be located at 195 Broadway, New York. Mr. Pingree first became connected with the Western Electric Company in 1903 when he started in financial work in Chicago. During the next three years he held various positions in Chicago, Cincinnati and New York, becoming assistant treasurer in 1907. The following year he was appointed telephone sales manager and in 1909 was sent to China as a special agent. In 1909 he went to London as manager, and three or four years later became managing director of the London house.

W. O. POWERS, of the engineering department of the Postal Telegraph-Cable Company, New York, has joined the engineering force of the Western Electric Company, New York.

J. E. SHUFF, new-business manager of the Lincoln Gas & Electric Light Company, Lincoln, Neb., has been re-elected secretary and treasurer of the Nebraska Electrical Association.

THOMAS N. MEHAN, formerly a salesman for the Electric Appliance Company, Chicago, Ill., in the Central States, has joined the sales force of the Utilities Indemnity Exchange, St. Louis, Mo.

M. T. MAGUIRE, Rosemont, Pa., formerly in charge of the power plant of the Bethlehem Steel Company, South Bethlehem, Pa., has resigned to accept a position with the Symington Company, Chicago, Ill.

RICHARD VAN RAALTE has resigned his position in the advertising department of the General Electric Company, Schenectady, N. Y., to become advertising manager of the Holtzer-Cabot Electric Company, Boston, Mass.

J. F. OWENS, vice president and general manager of the Oklahoma Gas & Electric Company, has been appointed a member of a committee to raise $90,000 for the new Y. M. C. A. building in Oklahoma City.

S. MORGAN BUSHNELL, formerly with the Commonwealth Edison Company, Chicago, and more recently connected with the Illinois Maintenance Company, has joined the forces of Critchell, Miller, Whitney & Barbour, agents for insurance companies of England and America. Mr. Bushnell has taken an active part in the work of the National Electric Light Association and in 1911 was appointed chairman of the central station heating committee of the Commercial Section of the organization.

F. D. PHILLIPS, vice-president and sales manager of the Central Telephone & Electric Company, St. Louis, Mo., was elected president at a recent meeting of the board of directors of that company. Mr. Phillips has been an active member of the Jovian Order since his affiliation, having served as secretary and on various committees of the St. Louis league. He is also a member of the St. Louis Chamber of Commerce and of the executive committee of the Sales Managers' Bureau of that organization.

Obituary.

SAMUEL INSULL, SR., father of Samuel Insull, president of the Commonwealth Edison Company and chairman of the State Council of Defense of Illinois, passed away on September 15 at his home in London, England. On September 10, deceased reached his eighty-seventh year. Mr. Insull's mother, Emma Short Insull, died on April 5 of this year.

After the War, What?

III.

Protecting Your Business

The Government has so many immediate vital problems that it must leave it to the individual to protect the future of his business.

The business man must obey the Government, but he must also think for himself and use every effort to protect his own industry for such time as its resources and activities shall count for peace-time prosperity and the big general production which will be needed to ensure a wealthy country to pay national debts and provide for national expansion.

Therefore, it is a great and vital task to keep name, trademark, or commodity in the favorable mind of the public even while demand is greater than production can be.

No matter how keenly and whole-heartedly intent we are on winning the war in the American fashion, we must not forget for one moment that he who wins a battle but comes out in a disabled and crippled condition cannot remobilize himself in such a way as to enjoy the full fruits of his victory and we must not forget either that every man is just as responsible for the success and stability of his own business organization now during the war, and later during peace, as he ever was.

HOWARD W. DICKINSON,
New York

Following are extracts from the "Relation of the War to Advertising," written by the Vice-President of the Geo. Batten Company, 381 4th Ave., New York, copies of which can be obtained on request. It is a text book on present conditions which every manufacturer should study.

INTERNATIONAL TRADE PRESS, Inc.
C. A. Tupper, President . CHICAGO

Financial News

Labor's Obligation and the Public Utilities.

"The Union," the leading labor newspaper of Indianapolis, Ind., recently contained an editorial on the above subject, portions of which are quoted:

"In this and other states the companies generally were admitted to be economically and efficiently administered and owned by persons who paid for their interests in real money. If the companies that had offended in exploitation were to be held as a sample of the whole and all to be punished for the sins of the few then we were in a bad way. But people generally were willing to admit that the public service companies should be judged by their present needs.

"The rate-making body in this and other states, proceeding on the theory that half a loaf is better than no bread, granted some rate increases—and it is worthy of notice that only in a few cases was there material or substantial opposition to these raises—and the bulk of that by people who had one eye on the gallery and the other on their own petty interests.

"There has been little if any change made in the capitalization of these companies since the rates were fixed on a pre-war cost-of-production basis. The capital of the companies was reckoned with in fixing the old rates—or it should have been. The obvious and outstanding fact is that the companies cannot pay war prices for the materials they use unless their revenues are adjusted to war conditions. And the business of this country cannot be carried on without the continued operation of these utilities on the basis to which we have become used. All other consideration of the matter is superfluous and will get us nowhere.

"Labor must acquiesce in the new conditions. It must divest itself of the ingrained idea that increasing the revenues of the public service corporations means the segregation of that much wealth. It should make it clear in this state and other states that it is ready to accept new rates and to sustain the rate-making bodies in bringing the utilities out of the slough of impending disorganization. We cannot expect to take the war prices for labor without paying war prices for those commodities that are produced very largely by labor."

Public Utility Companies Petition for Increased Capital.

The following electric companies have filed notice with the Public Service Commission for increase in capital or bond issues for proposed extensions in plants and systems: The Ridgway Electric Light Company, Ridgway, $300,000 bonds and $105,000 capital increase; St. Marys Electric Light Company, St. Marys, $100,000 in bonds and $225,000 capital stock increase; the West Penn Power Company, Pittsburgh, $2,223,000 in bonds; Philadelphia Rapid Transit Company, Philadelphia, $18,000, bonds; Bradford Electric Light & Power Company, $3500, capital increase; Johnsonburg Light & Power Company, Johnsonburg, $25,000 bonds and $45.000 capital increase; the Wilkes-Barre Company, Wilkes-Barre, $200,500 in bonds. Each of the following electric companies, with headquarters at Bradford, have arranged for a nominal capital increase of $500, Bradford Township Electric Company, Foster Township Electric Company, Liberty Township Electric Company, Lafayette Township Electric Company, Keating Township Electric Company, the Port Allegany Electric Company and the Smithport Electric Company.

Commonwealth Power Plan Gains.

The Commonwealth Power, Railway & Light Company announces that considerably in excess of 90 per cent of the entire outstanding bond issue has been deposited under the plan for refusing the $8,000,000 6 per cent bonds, due May 1 last, and that a consummation of the plan for part payment and refunding will doubtless be accomplished in the near future.

Pennsylvania Electric Notes Offered.

Montgomery & Company, of New York and Chicago, are offering $1,500,000 five-year 7 per cent secured gold notes, of the Pennsylvania Electric Company, dated July 1, 1918, and due July 1, 1923. The Bankers' Trust Company, of New York City, is trustee under the mortgage. The Pennsylvania Electric Company, through three subsidiaries operates in Western Pennsylvania and serves fifty communities, including Johnstown, Clearfield and Indiana. The territory is rich in coal mines and produces 15,000,000 tons of coal annually. The territory has a population of 390,000

Earnings.

UNITED GAS & ELECTRIC.

July earnings subsidiary operating companies—Gross, $1,406,420, increase $92,515; net, $408,615, decrease $133,006; surplus after charges, $96,765, decrease $167,365.

COLORADO POWER COMPANY.

July—	1918.	1917.
Gross earnings	$ 103,547	$ 8,918
Net earnings	58,086	6,857
Total income	61,973	8,735
12 months ended July 31—		
Gross earnings	$1,262,293	126,100
Net earnings	725,148	96,293
Net income	413,692	91,439
Surplus after dividends	137,432	78,792

BYLLESBY UTILITIES.

Combined earnings of all Byllesby utility properties for the months of July, 1918 and 1917, and for the year ended July 31, 1918 and 1917, are reported as follows:

Month of July—	1918.	1917.
Gross earnings	$1,725,121	$1,392,922
Net earnings	652,213	626,900
Year ended July 31—		
Gross earnings	21,368,873	18,286,595
Net earnings	8,611,068	8,606,272

Dividends.

West India Electric Company, Ltd., has declared a quarterly dividend of 1¼ per cent, payable October 1 to stock of record September 23.

Ottawa Light, Heat & Power Company has declared a quarterly dividend of 1¼ per cent, payable October 1 to stock of record September 20.

Dayton Power & Light Company has declared a quarterly dividend of $1.50 on preferred stock, payable October 1 to stock of record September 20.

Electric Storage Battery Company declared a regular quarterly dividend of $1 on preferred stock and $1 on the common stock, both payable October 1 to stock of record September 16.

West Kootenay Power & Light Company has declared the regular dividend of 1¾ per cent on preferred stock and 2 per cent on common stock for quarter ended August 31, payable October 1 to stock of record September 30.

Utah Power & Light Company has declared the regular quarterly dividend of 1¾ per cent on preferred stock, payable October 1 to stockholders of record September 14.

Adirondack Electric Power Company has declared a cash dividend of $1.50 on preferred stock, payable October 1 to stock of record September 20.

Pacific Telephone & Telegraph Company has declared a quarterly dividend of 1½ per cent on preferred stock, payable October 15 to stock of record September 20.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

	Div. rate. Per cent.	Bid Sept. 10.	Bid Sept. 17.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	6	13	13
Adirondack Electric Power of Glens Falls, preferred	6	68	68
American Gas & Electric of New York, common	10+extra	81	80
American Gas & Electric of New York, preferred	6	37	37
American Light & Traction of New York, common	..	182	179
American Light & Traction of New York, preferred	6	91	91
American Power & Light of New York, common	4	40	40
American Power & Light of New York, preferred	6	66	66
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	6	..	33
American Telephone & Telegraph of New York	..	97½	98
American Water Works & Elec. of New York, common	..	4	4½
American Water Works & Elec. of New York, particip	7	12	11
American Water Works & Elec. of New York, first preferred	..	58	57
Appalachian Power, common	..	3	3
Appalachian Power, preferred	7	21	21
Cities Service of New York, common	+extra	209	208
Cities Service of New York, preferred	6	72	71¾
Commonwealth Edison of Chicago	8	101½	101
Comm. Power, Railway & Light of Jackson, common	..	20	16
Comm. Power, Railway & Light of Jackson, preferred	6	38	34
Federal Light & Traction of New York, common	..	7	7
Federal Light & Traction of New York, preferred	..	35	35
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	15	15
Middle West Utilities of Chicago, preferred	6	35	35
Northern States Power of Chicago, common	..	44	43
Northern States Power of Chicago, preferred	ex.div.7	80	81
Pacific Gas & Electric of San Francisco, common	..	34	32¾
Pacific Gas & Electric of San Francisco, preferred	6	78	76
Public Service of Northern Illinois, Chicago, common	7	75	75
Public Service of Northern Illinois, Chicago, preferred	6	82	78
Republic Railway & Light of Youngstown, common	4	19	18½
Republic Railway & Light of Youngstown, preferred	6	57	56
Standard Gas & Electric of Chicago, common	..	4½	4½
Standard Gas & Electric of Chicago, preferred	6	22	21
Tennessee Railway, Light & Power of Chattanooga, common	..	2	2
Tennessee Railway, Light & Power of Chattanooga, preferred	6	12	12½
United Light & Railways of Grand Rapids, common	4	30	29
United Light & Railways of Grand Rapids, preferred	6	60	58
Western Power of San Francisco, common	..	12	11
Western Power of San Francisco, preferred	6	48	48
Western Union Telegraph of New York	extra	83½	83
Industrials—			
Electric Storage of Philadelphia, common	4	52	52
General Electric of Schenectady	8	145	147
Westinghouse Electric & Mfg. of Pittsburgh, common	7	42¼	43¼
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	58	58

*Last sale.